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REFORM PROJECT
COMPENDIUM WITH PRACTITIONERS' GUIDE

State Fiscal Management Reform

The Project Appraisal Practitioners' Guide

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In addition, officials from the state governments of Jharkhand, Karnataka and Uttarakhand provided invaluable input to complete the sector-specific Guidelines.

REFORM
Rationale, Objective & Terms of Reference

The REFORM Vision .....

"State governments have the necessary organizational structures, analytical tools and decision-making processes, information sources and trained staff that enable them to make better informed choices on a transparent and accountable basis with respect to state public finances. Subsequently, this capacity is institutionalized into the mainstream of state government practices to ensure the sustainability of the effort."

The Rationale:

The starting point of the USAID/India Fiscal Management Reform Project (REFORM) is that the fiscal distress seen at the state level in early 2000 was, to a large extent, a result of the systemic weaknesses in state fiscal management (Box 1), including within the key departments of finance and planning. This prevented forward-looking fiscal decision-making grounded in careful analysis and leading to good governance. In short, the majority of Indian states needed better analytical capacity backed by appropriate institutional infrastructure to formulate and implement good fiscal policy.

Box 1: Systemic Weaknesses in Fiscal Management

The systemic weaknesses found in fiscal management at the state level may be described as "inadequate":

- Technical know-how in modern fiscal management practices.
- Comprehensive, current information databases.
- Robust analytical tools and techniques that correspond to internationally accepted standards.
- Integrated management information systems and systematic approaches to the fiscal decision-making processes.
- Transparent, consistent and institutionalized fiscal practices, reporting systems, and structures that promote the desired accountability for the effective and efficient mobilization, allocation and utilization of public funds.

Currently, therefore, many Indian states do not have the *appropriate capacity*[1] and the *necessary practices*[2] to perform relevant, economic and statistical analyses (Box 2).

Box 2: Consequence of Systemic Weaknesses

As a consequence of the systemic weaknesses, most Indian states, for example, have inadequate fiscal management expertise and institutional infrastructure to perform revenue and expenditure projections and distributional analysis, assess multiplier and elasticity effects, and run policy simulation and develop alternative policy scenarios. This includes their inability to establish strong links between budgetary outlays and program outcomes for efficient and effective delivery of results, establish debt and investment frameworks to improve their quality and profile, and conduct rigorous project appraisals to ensure selection of socio-economically viable projects.

[1] i.e., fiscal management skill-sets, tools and techniques and organizational structures.
[2] i.e., consistent, transparent and accountable processes.

Given increasing decentralization and the continued significance of public finance in India, many state governments will be required to assume greater responsibility for the design and implementation of their own development strategies. As a result, their ability to strike the *right balance between fiscal policy, broad-based growth, and financial sustainability* will be fundamental to promoting and sustaining development across every sector of the state economy and, consequently, the nation as a whole, especially in light of the new challenges posed by the opening-up of the Indian economy and state finances getting substantially linked with market forces.

The Objective:

As a response, USAID/India's REFORM project (September 2003 - 2008) was designed to provide practical hands-on "how to" skills transferal, based on international best practices, to strengthen fiscal analytical expertise, structures and systems of selected Indian states. The objective was to help these states to better plan and manage their public finances, especially in the light of the challenges they faced following the 2000-01 fiscal crisis. Jharkhand, Karnataka, and Uttarakhand were identified as the three REFORM partner states.

The specific objectives of REFORM were:

1) To improve "informed" decision-making within state (sub-national) governments;
2) To ensure that decision-making processes followed consistent and transparent principles, leading to greater accountability; and,
3) To sustain the efforts by institutionalizing and mainstreaming the capacity built.

> *REFORM, therefore, was not designed to advise or guide Indian state governments on specific policy decisions but rather to enhance their ability to evaluate and to address crucial policy choices and implementation options, based on an understanding of the environment - i.e., its potentials, its limits and its perceived needs.*[3]

Terms of Reference:

Based on discussions with the respective partner states, the REFORM terms of reference were to help enhance their fiscal management capacity in the following four (4) areas:

- *Revenue Management Capacity* – To help states undertake detailed analysis of revenue projections and the implications of alternative tax policies and revenue choices. Interventions included: Introduction of improved revenue forecasting methodologies, an Input-Output (I-O) framework and macro-economic database. A practitioners' guide was also developed along with hands-on training to build state capacity in the above areas.

[3] Capacity-building as defined by the United Nations Center for Education and Development, (Agenda 21's definition, Chapter 37, UNCED, 1992).

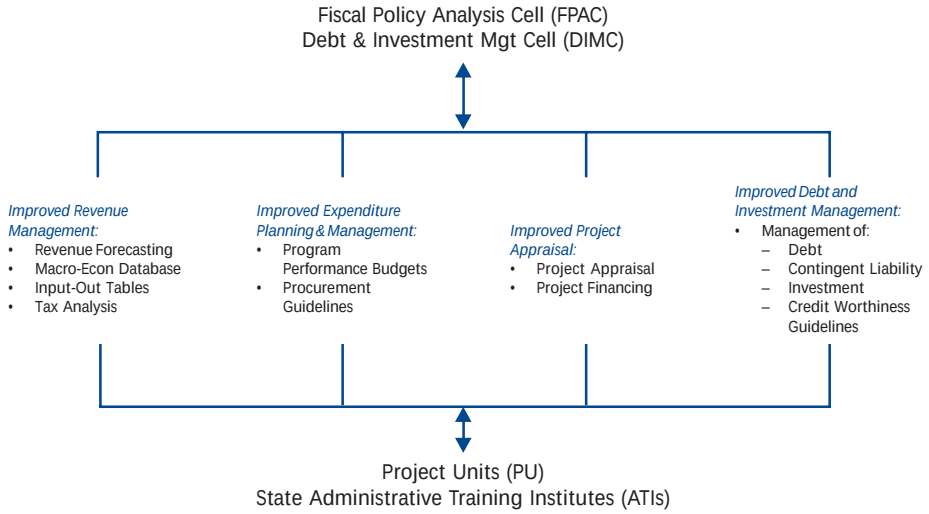
- *Expenditure Planning and Management Capacity* – To help states improve quality and accountability of expenditures. Interventions included: Introduction of an outlays to outcomes budgeting methodology (*i.e.*, program performance budgeting (PPB)) to help states' prioritise the allocation of public funds, improve program planning, monitoring and evaluation, increase transparency, accountability, and consequently, the quality of public services delivery. A practitioners' guide with related software was developed and delivered. Structured/hands-on training was provided across all levels and in almost all departments. Detailed public procurement guidelines were also developed for two out of the three states.
- *Debt and Investment Management Capacity* – To help states to better document, track, analyze, and manage debt, contingent liabilities and investments, in the medium to long term. Interventions included structured and hands-on training as well as introduction of practical guides (with reporting templates). Comprehensive debt datasets were developed and migrated into a database using the *Commonwealth Secretariat-Debt Recording and Management System (CS-DRMS)* software.
- *Project Appraisal Capacity* – To help states improve appraisal and selection of socio-economically viable capital projects. Interventions included: Training in the Harberger project appraisal technique which involves financial, economic, social and stakeholders' risks analysis. A Project Appraisal practitioners' guide with sector-specific guidelines was also developed and introduced to serve as a desk reference.

To sustain and mainstream the above fiscal management reform efforts, four (4) institutional structures were designed and supported:

- The Fiscal Policy Analysis Cell (FPAC) – To help states institutionalize continuous analysis of the implications of policies, procedures and regulatory decisions on the fiscal health of the states. An analytic unit supported by a team of dedicated and trained staff, with access to relevant and quality data, tools and techniques was established.
- The Debt and Investment Management Cell (DMIC) –To help states identify, generate, and analyze data and support more effective and prudent debt/investment decision-making. Similar to the FPAC, an analytic unit supported by a team of dedicated and trained staff, with access to relevant and quality data, tools and techniques was established.
- Project Unit (PU) – To help states offer a comprehensive range of services from project appraisal and monitoring, to final end-of-project evaluation, a project unit was designed that would also help promote public-private partnerships (PPPs).
- Administrative Training Institutes (ATIs) and State Institutes for Rural Development (SIRDs) – To help state civil service training institutes (ATIs and SIRDs) train entry level and mid-career state civil servants in fiscal planning and management, training courses; training materials and reference guides were developed and provided.

The REFORM project may therefore be considered as four-by-four (4x4), consisting of four intervention areas (expenditure, revenue, project appraisal, and debt and investment management) supported by four institutional structures (FPAC, DMIC, PUs, and ATIs/SIRDs).

REFORM: Four-by-Four



The Final Products:

A project *Compendium with Practitioners' Guides* was developed under REFORM to assist state governments to implement necessary fiscal management practices in the areas of forecasting, budgeting, tracking of debt and investment, and improving project appraisal techniques. Specifically, these Guides were developed to function both as desk references for government officers earlier trained under REFORM as well as training tools for strengthening capacity of new officers. For officers not earlier exposed to the new fiscal practices, the Guides will need to be supplemented with additional technical support or guidance.

The Compendium also includes a variety of case studies including the experiences of the three REFORM partner states – Jharkhand, Karnataka, and Uttarakhand – with respect to the implementing the new practices under REFORM.

"Fiscal Watch", a virtual resource center, has also been designed and launched to provide a dedicated site to promote greater thinking, collaboration, discussions, best practices and, exchange information and post current data on the fiscal health (and related issues) of Indian states and India. The key feature of "Fiscal Watch" is the dedicated discussion forums to facilitate interaction between fiscal practitioners, both Indian and international (*e.g.*, to provide a platform for finance secretaries, budget officers, revenue officials, and researchers). In addition, there are numerous hyperlinks to related online resources such

as government websites, professional societies, consultancy opportunities, and training and education providers.

To Conclude:

Despite spending large sums of money, governments and donors in many countries have been limited in their ability to develop successful, sustainable programs due to the inadequacy of fiscal management expertise and infrastructure. Such inadequacies prevent the productive absorption of funds. They also prevent states from equipping themselves with the necessary fiscal shock absorbers to cushion them against unexpected fiscal challenges - some arising out of discretionary, unplanned decision-making and others as a result of increased globalization. More often than not, these unexpected challenges can and have served as the tipping points, seriously affecting the fiscal condition of even fiscally healthy states, as seen in India especially post 1995-96.

However, given the increasing recognition by state governments of the role of and need for improved fiscal management capacity in Indian states' development process, and indeed for India as a nation, we are confident that endeavors such REFORM will be sustained and further strengthened.

Madhumita Gupta, Team Leader REFORM, USAID/India

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Why Develop this Guidebook?

The purpose of this Guidebook is to help an Indian State Government implement the use of international best practices of Project Appraisal while approving a public sector project.

Specifically, this Guidebook has been developed to assist state governments to develop and evaluate investment projects to promote economic and social well-being. It describes how public sector investments should be evaluated so that they may be taken from the idea stage to the implementation phase in a successful manner. These themes will be addressed under three headings: *financial, economic, and distributional* analysis of a project.

By their very nature, investment projects involve benefits and costs over a number of years into the future. Market prices and project outcomes cannot be predicted with certainty. In addition, technical difficulties and delays in implementation frequently result in cost and time overruns. Given this uncertainty, account must be taken of a project's risks and the costs that these risks create. *Risk analysis*, and how to reduce and manage risk through the use of contracting, and other risk mitigation methods, will constitute the fourth Section of the Guidebook.

What is the Guidebook?

The Guidebook is a supplement to training of those employees who are not familiar with the methodology of project selection using Net Present Value (NPV) criteria. It helps employees of the operating departments understand the methodology for viable project selection. The Guidebook contains an introduction to project appraisal techniques, a detailed discussion on financial, economic, stakeholder and risk analysis, and some practical recommendations on how to proceed.

When to use the Guidebook?

Once a state government has decided to adopt this methodology for approving the projects, the state can use the Guidebook as a desk reference.

Who should use the Guidebook?

This Guidebook is intended for a number of users in these states. First, it serves as a guide to the public sector managers responsible for making public sector investment decisions. This group includes not only project analysts and decision makers within the ministries of planning and finance, but also those employed in the line ministries, and government departments and agencies that are involved with the formulation, evaluation and implementation of projects. Second, the Guidebook is meant to be used for training purposes by the training institutions to educate and train the future managers in these states. Finally, it provides an assurance to the international development and lending institutions that the funds provided to the states will be spent in a responsible and productive way.

The Guidebook is intended for a number of users within the State Governments. First, it serves as a guide to the public sector managers responsible for making public sector investment decisions. This group includes not only project analysts and decision makers within the ministries of planning and finance, but also those employed in the line ministries, and government departments and agencies that are involved with the formulation, appraisal and implementation of projects. Second, the Guidebook is meant to be used for training purposes by the training institutions to educate and train the future managers in these states. Finally, it provides an assurance to the international development and lending institutions that the funds provided to the states will be spent in a responsible and productive way.

How to use the Guidebook?

The Guidebook serves as a baseline tool to assist state governments to implement necessary fiscal management reform. The compendium includes guidelines for on-the-ground implementation of international best practices by state officials in the areas of forecasting, budgeting, tracking of debt and investment, and improved project appraisal. These guidelines have been developed with the aim of serving both as desk references for government officials already trained in the respective fiscal competency as well as training tools for structured capacity-strengthening programs. For officials not already exposed to the fiscal practices introduced under REFORM, the guidelines will need to be supplemented with technical support or guidance.

Current Project Appraisal Status in India

The Subnational governments in India practically without exception have registered either declining or stagnant own nontax revenues as percentage to their respective GSDP over the years. While decomposing the aggregate own nontax revenues of all States, the two sources — *i.e.*, receipts from economic services and profits and dividends provide a very dismal picture as given:

Table 1: Public Reforms on Investments (as a % of GSDP)

	2003-04	2004-05	2005-06	2006-07 (RE)	2007-08 (BE)
Dividends and Profits as % of GDP	0.01	0.01	0.16	0.01	0.01
Receipts from Economic Services as % of GDP	0.60	0.73	0.60	0.59	0.64
Total Own Nontax Revenue as % of GDP	1.39	1.51	1.34	1.34	1.30

The factor contributing to this situation has been ,inter alia, the low or negative return from investment of the projects of the States. Returns of the projects almost invariably did not cover the debt servicing liability nor it were near the recovery of the O&M cost. In the past, before deciding in favor of launching a project, seldom there had been systematic project appraisal at the State level. This, in turn, has added to cumulative adverse impact on the deteriorating fiscal health of the States and the burgeoning fiscal deficits. Thanks to the buoyancy of the economy and the improvement in the tax revenue front, the States are now in better fiscal position though the nontax revenues are still a matter of concern and need urgent attention.

With the improvement in overall fiscal health, the States in aggregate would be able to create a financial space on the revenue account to contribute to the capital outlays, which is showing a rising trend as shown in Table 2.

Table 2: Indian States Capital Revenues (as % of GSDP)

	2003-04	2004-05	2005-06	2006-07 (RE)	2007-08 (BE)
Capital Outlay in INR crores	52426	61559	77559	104942	118796
Capital Outlay as % of GDP	1.90	1.96	2.17	2.53	2.61

Barring a few, the States have enacted FRBMA. As such, it is expected that States will be able to eliminate the revenue deficits by 2008-09. The surplus generated on revenue account and the entire borrowed amount would now be spent on financing the increased capital outlay for creation of assets. However, the States have stipulated to keep the fiscal.

Deficit within 3 percent of the GSDP from 2008-09 onwards as per the FRBMA. Besides, following the recommendations of the Eleventh Finance Commission and the Twelfth Finance Commission, the Ministry of Finance has been imposing global annual borrowing cap to the States which is kept in view by the Planning Commission of India while finalizing the Annual Plan size and its scheme of financing of the States. Therefore, the fund available to the States to finance the developmental projects has been limited in comparison to the need and hence calls for judicial steps by informed decision making for selection of projects.

While recommending the need for better expenditure management of the States, the Twelfth Finance Commission observed "Issues of efficiency require consideration whether the same outcome can be achieved at lower costs and whether the same costs can produce better outcomes. Thus, the management of public expenditures should be guided by economy, efficiency and effectiveness. "According to the Approach Paper of the Eleventh Five-Year Plan, the Planning Commission is considering making it a firm condition that all proposals submitted to it must require sufficient benchmarking before approval. It also plans to strengthen its evaluation capacity by involving research institutions and civil society organizations which have the capability of undertaking rigorous evidence based evaluation. State governments, therefore, has to put in place a system for initiating measures for appraisal, monitoring and evaluation of plan programs as a counterpart action.

As per the expenditure assignments, the Indian States are responsible for most infrastructure services except for telecommunication, civil aviation, railways and major ports. Inadequate investment in infrastructure has constrained the growth and development of the States. The States would need to strengthen their finances through fiscal, structural and institutional reforms which would enable them to release adequate budgetary resources as also enable them to mobilize funds more easily for financing infrastructure. To generate sufficient fund, the States are utilizing two routes namely Public-Private Partnership (PPP) and Externally Aided Projects. In both the cases, careful

planning is required to avoid loss of scarce resources. The States, under the circumstances, would be requiring utilizing the techniques of the project appraisal for informed decision-making.

With bulk of the responsibilities pertaining to public expenditure on social services placed in the domain of State Governments, it is widely recognized that the level of social sector expenditure has important implications for the level of human development. As per the millennium development goals prescribed by the United Nations (UN) in 2000, the countries need to achieve targets particularly relating to social sector by 2015. As most of the millennium development goals relate to social sector, the States have a major role to play in reaching the targets by adequate investments. Contrary to the traditional belief that if a social sector project is economically sound, its financial analysis is of little consequences, the financial cash flows are crucial for projecting the cash position of the project in the future and determining if and when cash injections from the State budget would be necessary. If the project can't be implemented due to paucity of fund and lack of advance planning, there is not going to be any economic benefit from the project. Thus, it is expected that the use of project appraisal techniques would be prevalent at the sub-national level as the Indian States would go for increasing social sector investments.

An Overview of the Guidebook

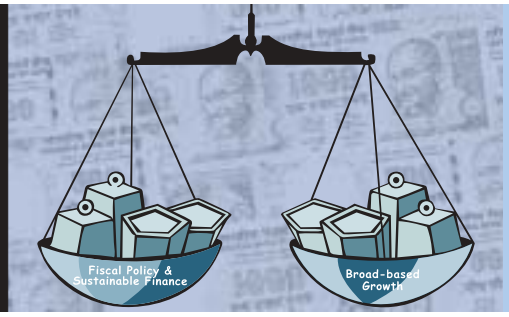
The Guidebook has been divided into three Sections. Section I will focus on the theory and methodology of project development and appraisal (cost-benefit analysis); examples will be provided to illustrate many of the points.

Section II of the Guidebook will present sector specific guidelines mainly for conducting the economic analysis of selected sectors. The key sectors that have been included are:

- Electricity;
- Road and transportation;
- Irrigation;
- Water supply;
- Agricultural extension;
- Housing;
- Tourism;
- Biomedical waste management; and
- Education and health.

Finally, Section III will consist of case studies developed by the participants on how to apply the theory and methodology from Section I and Section II to real-life projects from the selected sectors of GOAJ. The spreadsheets of the case studies will be put as the Annexures.

Users of this Guidebook will hopefully go back and forth between the theory and the case studies to gain a thorough understanding of how to apply the principles of project evaluation to the analysis of investment opportunities in the public sector.



Section 1

Project Appraisal Methodology

Part 1: Introduction

Purpose of the Project Appraisal Guidebook

The purpose of the *Project Appraisal Guidebook* is to help state governments develop and evaluate investment projects to promote economic and social well-being. It describes how public sector investments should be evaluated so that they may be taken from the idea stage to the implementation phase in a successful manner. These themes are addressed under three headings: *financial, economic, and distributional* analysis of a project.

By their very nature, investment projects involve benefits and costs over a number of years into the future. Market prices and project outcomes cannot be predicted with certainty. In addition, technical difficulties and delays in implementation frequently result in cost and time overruns. Given this uncertainty, account must be taken of a project's risks and the costs that these risks create. *Risk analysis*, and how to reduce and manage risk through the use of contracting, and other risk mitigation methods, constitutes the fourth Section of this Guidebook.

The Targeted Users of the Guidebook

This Guidebook is intended for a number of users in these states. First, it serves as a guide to the public sector managers responsible for making public sector investment decisions. This group includes not only project analysts and decision makers within the ministries of planning and finance, but also those employed in the line ministries, and government departments and agencies that are involved with the formulation, evaluation and implementation of projects. Second, the Guidebook is meant to be used for training purposes by the training institutions to educate and train the future managers in these states. Finally, it provides an assurance to the international development and lending institutions that the funds provided to the states will be spent in a responsible and productive way.

What is a Project?

In capital budgeting, a *project* is the smallest, separable investment unit that can be planned, financed, and implemented independently. This helps to distinguish a project from a program that may consist of several interrelated or similar investments. While it is possible to treat the whole program as a project for the purposes of analysis, it is advisable to keep projects limited in scope and close to the minimum size that is economically, technically and administratively feasible. If a project approaches program size, there is a danger that a highly profitable component may mask an unprofitable activity.

In general terms, *project* refers to a great variety of activities that may range from single-purpose activities such as small infrastructure projects to more complex multipart projects such as integrated hydroelectric projects with irrigation, power and tourism as its components. For the purposes of this Guidebook, which is focused on relatively small and medium scale projects typically found at state and regional levels, a *project* may be defined as "an activity that involves the use of scarce resources during a specific time period for the purpose of generating socioeconomic return in the form of goods and services". Thus, a *project* may be viewed as an investment that encompasses not only the physical infrastructure facilities such as roads, irrigation canals and drinking water

facilities but also development services such as agriculture extension, health and education.

Project as an "Incremental" Activity

An investment opportunity usually involves incremental net cash outflows or economic costs in the initial investment or construction phase followed by incremental net cash inflows, or net economic benefits, in the operating phase. An incremental net cash flow refers to the net cash flow, or net economic benefit that occurs with a project minus the net cash flow, or net benefit that would have occurred in the absence of the project. In this way, it is possible to identify the additional net cash flow, or net economic benefit that is expected to arise as a result of an *additional or new* investment through a project and to measure the corresponding change in wealth, or in economic well being that can be attributed to it.

Uncertainty and Contractual Arrangements

Although this is the standard view of a project, and one that will be analyzed in the Parts related to the financial, economic and distributive analyses it is not the complete picture. Uncertainty prevents an analyst from precisely identifying the time path of the net cash flows or net benefits. The best that can be said is that the anticipated benefits and costs are likely to lie in a given range with a given probability. Thus, the output of a project appraisal is more than just a point-estimate of a project's net return. A project evaluation should provide some assessment of the expected variability of a project's net return, the probability of a negative return, the cost of risk and who is likely to bear it.

Even with this information, the profile of a project is not complete. There is also a need to know and understand a project's contractual environment. For example, there may be alternative financing arrangements that would help to redistribute some of the risk and make a project more attractive. Or there may be contracts that project managers enter into with its customers/end users or its suppliers. These different arrangements could also create incentives or disincentives that would encourage a project's participants to alter their behavior and change the overall returns.

The effects of this uncertainty and the contractual arrangements are an integral part of project appraisal and are dealt with in the risk analysis part of the Guidebook.

An Overview of the Guidebook

The Guidebook is divided into three Sections. Section I focuses on the theory and methodology of project development and evaluation; examples are provided to illustrate many of the points. Section II consists of 11 case studies on how to apply the theory and methodology from Section I and Section II to real-life projects from the three states.

Users of this Guidebook will hopefully go back and forth between the theory and the case studies to gain a thorough understanding of how to apply the principles of project evaluation to the analysis of investment opportunities in the public sector.

Part 2: Project Development and Approval Cycle

Project Development Cycle

Every project has certain phases in its development and implementation. These phases are useful in planning a project as they provide a framework for resource allocation, scheduling project milestones for implementation, and establishing a monitoring system. The purpose is to provide a basis for organizing the project for establishing resource requirements, and set up the management system that will finally guide the project activities. The phases of project development are commonly referred to as the project development cycle or project life cycle. The project life cycle phases may be broadly placed in the following categories:

- Concept or identification;
- Definition or preparation;
- Prefeasibility;
- Feasibility and financing;
- Detailed design;
- Implementation and monitoring; and
- Ex post appraisal and impact evaluation.

In the concept or identification phase, the public sector manager evaluates an idea. In the definition or preparation phase, it elaborates and refines the concept and does some initial work to define the components that make up the project. The prefeasibility and feasibility phases comprise a more analytical exercise in which the viability of the project is examined from different points of view and the project is planned in detail. These two phases of the project cycle taken together mainly constitute the process of evaluation or appraisal of the project.

In the next phase of detailed design, the physical design of the project is completed and the plan for administration, operations, and marketing is finalized. The bulk of the actual work on the project is, of course, accomplished in the implementation phase. Finally, a critical evaluation of the project's outputs and outcomes is conducted in the last phase. As the project moves through its life cycle, the focus of managerial activities shifts from planning to operating and controlling the activities.

It should be emphasized that these phases only represent a natural order in which projects are planned and carried out and they are not sequential. Also, several of these phases do not become final until the project approaches its termination stage. The project development cycle is a continuous and dynamic process and there is a great deal of overlap, interaction and feedback among the various phases. Many of the activities are interrelated and cannot be confined to one particular phase.

Projects and State Development Plans

Projects provide a valuable tool for directing investments into the priority sectors of an economy. A state or regional plan lays down growth targets for various economic parameters like consumption, public and private sector investments and gross state product. This exercise of macroeconomic planning is meaningful only when it is possible to make realistic assumptions about the level of investment that can be achieved in a certain period of time and its impact

on the rate of growth. This presupposes knowledge of the existing and potential projects in the state sector and the pace at which they may be implemented.

It is also the main objective of the planning process to direct investment to those sectors where it will yield the maximum economic benefits to the state. Again, within a sector priority needs to be given to projects with the highest economic returns. It is possible to make this kind of judgment only with the help of economic analysis of projects. Thus the planning process is hardly relevant without project planning and without a rigorous analysis at the sector and project levels.[4]

The reverse linkage between projects and plans is equally strong. For making a choice among projects, it would be necessary to estimate the market demand for the goods and services produced by those projects. Thus, the microeconomic planning at the project and sectoral levels clearly depends upon how the overall economy is likely to develop in the course of time which, in turn, is a function of the long range plans and policies of the state government.[5] Thus the analysis of a project within the overall framework of a state plan should be more realistic as compared to a situation where no plan exists.

This clearly indicates a close interaction between project analysis and plan formulation.[6] A plan may be initially formulated without an adequate knowledge of the role of individual projects or sectors in the overall growth of the economy. This will sharpen the focus of the micro level planning. An improvement in the analysis of projects and sectors will help improve the quality of macroeconomic management. Thus there is a feedback process between project analysis at the microlevel and planning at the macrolevel.

Concept or Identification Phase

This is the first phase of the project cycle and is concerned with the identification of potential projects. The purpose is to establish the basic desirability of a project and identify the high priority projects.[7] The type of projects that would qualify for being placed in this category will largely depend upon the level of development of the economy. States and regions differ with respect to their problems as well as their growth potential.

Action Points in Project Identification

The identification process implies undertaking of two sets of activities. First, the gaps in the economy should be identified and second, the sector priorities should be defined. These activities are truly dynamic in nature and keep evolving over time. Both these tasks are routinely performed during the planning process at the state, regional or district level. A thorough analysis of the gaps in development

[4] See Little, I. M. D. and J. A. Mirrlees; "Project Appraisal and planning for Developing Countries", Basic Books, Inc., New York (1974) for a discussion on the strong interlinkage between plans and project choice.
[5] See Kaufmann, D. and Yan Wang, "Macroeconomic Policies and Project Performance in the Social Sectors: A Model of Human Capital Production and Evidence from LDCs," World Bank (1995).
[6] The integration between project planning and national or macrolevel planning has been a significant issue in the literature on project analysis. At the micro level the individual projects have to be feasible while at the macro level a set of projects has to be selected that are collectively feasible and fit into a national perspective. See Noorbaksh (1993) for an excellent discussion of this issue.
[7] Baum, Warren C., "The World bank Project Cycle," in Finance and Development delineates and discusses the phases of the project cycle in the context of World Bank funding of public sector projects.

and the potential for growth is undertaken at the time of plan formulation and during periodical reviews. This also enables a continuous assessment of the progress and the shortfalls and provides valuable feedback to the policy makers.

The gaps in the economy could lie in one or more sectors such as basic infrastructure, food and agriculture, heavy or basic industry, or social sectors such as health and education. In practice, the identification of gaps is not a difficult task. What is difficult is the setting up of a clear priority among competing claims on the limited resources of the state or the region. This, in fact, constitutes the crux of the development problem and is the most difficult challenge that planners and policy makers face.

Problems in Project Identification

The following set of problems is often encountered in the process of project identification.

Resource surveys and project identification:[8] The lack of finances and scarcity of skilled manpower has acted as a major deterrent in carrying out detailed resource inventories that are needed for identifying projects and for rationalizing development plans. This is more so in agriculture, rural industries and natural resources sectors where detailed information can be obtained only after sustained research and survey work. There has been a tendency to move ahead with investments in certain sectors perceived as lead sectors, such as industries, rather than spending resources on research and surveys that would identify higher return areas

Once a project is identified, the process of preparation is initiated. This process involves the refinement of the elements described in the identification phase and includes all the steps that are necessary to bring the project to the stage of appraisal, which would consist of prefeasibility and feasibility studies.

that are perhaps not as obvious. For example, the rate of return on road repair and rehabilitation projects have tended to be much greater than the rate of return for new roads but the rehabilitation projects usually do not get due priority. The emphasis is mostly on initiating new projects.

Lack of skills to produce project alternatives: While capital scarcity is one of the main constraints, the problem of project scarcity is equally serious. Often, human resources do not exist in the state or the region for identifying suitable project interventions that are required to fulfill the plan objectives and achieve the development goals. Thus, there may be simply a lack of skills to produce project alternatives.

Sources of Project Identification

A project may be identified in a variety of ways.

- Conceived by existing departments or ministries in the government.
- Emerge out of the process of formulation of plans at state, regional and district levels.
- Identified by the people's representatives.

[8] Ward, William A., and Barry J. Derren, "The Economics of Project Analysis: A Practitioner's Guide," Economic Development Institute of the World Bank (1991) presents an excellent analysis of the various aspects of strategic planning and project appraisal.

- Proposed as a demand from interest groups or beneficiaries.
- Product of a dialogue between the state on one hand and the central government, the donors and international agencies on the other.

Preparation Phase

Once a project is identified, the process of preparation is initiated. This process involves the refinement of the elements described in the identification phase and includes all the steps that are necessary to bring the project to the stage of appraisal, which would consist of prefeasibility and feasibility studies. While it is difficult to generalize about the preparation phase as it depends upon the nature of the project, preparation begins with the description of objectives, identification of the principal issues and setting up of a timetable for the different phases of development cycle. While many of these issues would have already been considered at the identification phase, all these aspects are addressed in greater detail during the preparation phase and concrete answers are sought to the various questions that arise in the context of the project.

The preparation stage should be followed by the prefeasibility phase. The prefeasibility study is one of the two components of appraisal, the feasibility study being the other one. This is the first attempt to examine the overall potential or viability of the project.

It may be noted that the process of preparation must cover the full range of technical, institutional, financial and economic issues that are relevant to achieving the project's objectives. For instance, an irrigation project would require a study of several aspects such as the existing soil patterns and available water resources, appropriate cropping patterns for the area based on data available with the agriculture department, impact of the facility on a typical farm budget, extension services in public and private sectors, marketing infrastructure in the region, existing land tenure systems etc.

Policies and Procedures

Sometimes it may be necessary to examine the government policies and procedures that would have a major impact on the outcomes of the project. Also, sociological studies may be needed to ensure that the project fits into its physical and social environment so that its benefits are maximized. In the case of the irrigation project, for example, the government policies with respect to prices of inputs and agricultural products, the method for determination of user charges from the beneficiaries and the procedure for collecting these charges would have to be examined.

Technical and Institutional Alternatives

An important element of preparation is a critical assessment of the technical and institutional alternatives for the project. This is essential for the choice of an appropriate technical package necessary to implement the project and identification of the agency or unit that would be responsible for project management. The choice of technology will largely depend upon the resource endowments of the state or region and the stage of its development. For instance, most states in India suffer from a lack of capital but are abundant in labor. Thus some types of advanced technology may not be the most suitable for the specific state or region. The preparation phase requires an analysis of the

benefits and costs of the technical and institutional alternatives followed by a more detailed investigation of the more promising alternatives. The process continues till the most satisfactory solution is arrived at.

It is evident that this process of project preparation is both time consuming and requires trained staff and financial resources. Each project means a long-term commitment of scarce resources and serious economic implications for the state. Therefore, the time and money spent in selecting the most suitable technical and organizational alternative is well spent because over the long term this effort will most likely be returned many times over by the enhanced return from the investment.

Prefeasibility Phase

The preparation stage should be followed by the prefeasibility phase. The prefeasibility study is one of the two components of appraisal, the feasibility study being the other one. This is the first attempt to examine the overall potential or viability of the project. The data and information gathered at the preparation stage are used in this phase. It is a critical stage of the project cycle because it is the culmination of all the preparatory work and provides a comprehensive review of all aspects of the project before taking a final decision about its viability.

The prefeasibility study is the stage for completing all the preliminary steps for going into a detailed feasibility exercise. Thus, it is the first part of conducting the appraisal of a project. Also, if a project does not prove to be promising at this stage, it may be rejected without investing any additional time and resources into its further examination and the process of appraisal is over for the project.

The prefeasibility phase should normally comprise the following modules:[9]

Marketing or Demand Module

This module examines whether there is a demand for the goods/services of a project both in the domestic market, and the neighboring states. In many states, it is not unusual to come across defunct projects that were taken up because of political expediency or availability of funds from the central government for that type of projects but there was not sufficient demand for the good or service produced at that time to enable the project to become either financially or economically sustainable.

The function of this module is not only to assess the current demand but also to undertake the more difficult task of forecasting the future demand. For the demand analysis of a product or service, it is necessary to conduct some primary research at the prefeasibility stage by surveying the potential customers and users.

In the case of public sector monopolies, such as public utilities, government policies are an important factor in determining the demand for the output. Programs like electrification of rural areas and promotion of industrial complexes in urban areas will have an important bearing on the future demand for electricity. The growth in demand for the output of a public utility may be forecast fairly accurately by studying the relationship over time of demand with respect to variables such as population growth,

[9] See Jenkins, et al. (1998) for a discussion of the various aspects of project planning or the prefeasibility phase.

disposable income, industrial output, and relative prices. The study of growth in demand experienced by utilities in other states can also provide a good indication of what to expect in the future.

Technical or Engineering Module

It looks at the input parameters of the project, quantities and prices of inputs by type required for construction of the project, inputs required for the operation of the project by year and volume of sales or service delivery, and the appropriateness of the technology adopted. It is also concerned with issues such as the size of the project, its design and location and the technology to be adopted including the equipment used and the processes employed. In a canal system for irrigation, for instance, this module will be concerned with the size and gradient of the main canals, the volume of expected water flow at the source, locations and numbers of secondaries, impact on the water table in the region and the availability of drainage facilities for excess water.

A major task in this phase is to conduct a close scrutiny of the cost estimates of construction along with the engineering data used to arrive at those estimates, provisions for contingencies and expected price increases during the implementation phase and cost estimates for operating the facilities. The procedures for procurement of materials and provision of professional services are also reviewed at this stage.

The output from the technical module of a prefeasibility study should provide the following information:

Environmental Module

Several projects have a negative impact on the environment that may affect a group of people in the society adversely. This is an externality generated by the project and is not reflected in the private costs of the project. Industrial firms and infrastructure projects, such as power and transport, create different kinds of pollution that fall in this category. Some projects may deposit a lot of waste products or effluents in the atmosphere, waterways and the ground and these may have serious health implications. Again, the emissions from some projects have long-term impact on the global climate that may prove to be irreversible. All these have a damaging effect on people and property that are not directly involved with the production or consumption of the output. The waste products emitted by one producer may adversely affect the production processes of other firms or well-being of other consumers.

While this externality may not concern the private producer unless its cost is internalized through some mechanism of regulation, tax or subsidy, it certainly imposes a cost on the society and must be taken into account when the project is examined from the point of view of the economy. If this aspect of costs were ignored, investments that are not socially desirable would appear to be attractive and are likely to be included in the state's portfolio of development projects.

Whenever the project has an impact on the environment, all costs of pollution control equipment and facilities should be included in project cost. Whatever residual pollution and environmental impacts remain after the

pollution control equipments are in place should be estimated and its economic value assessed. Finally, these values should be included as a cost in the economic cash flow of the project.

Manpower and Administrative Support Module

This module goes into the manpower requirements both for construction and operation phases of the project. It reconciles the technical and administrative requirements of the project with the supply constraint on manpower.

It is a mistake to confine project appraisal to the analysis of financial and economic costs and benefits under the assumption that the project can be built and ready for operations on time. This assumes a degree of administrative support for implementation of projects that in many states and regions does not exist. Many projects have failed because they were undertaken without the administrative expertise necessary to complete the project as specified. The prospect that future financial and economic benefits will materialize is only as good as the administrative capability of the agency in charge to put the project in place.

This module must reconcile the technical and administrative requirements of the project with the supply constraints on manpower. A careful study of the labor markets should be made in order to ensure that the estimates of wage rates to be paid are accurate and that the planned source of manpower is reasonable in the light of labor market conditions. In general, manpower requirements should be broken down by occupational and skill categories and these needs should be evaluated in terms of the possible sources from which they would be met.

Some of the elements of project costs and benefits such as environmental pollution, better health and education facilities, manpower training may not be easy to quantify. The best approach in such cases would be to find people's willingness to pay for the service or their willingness to pay for avoiding a negative outcome.

Institutional Module

This module deals with the creation of a local institution responsible for managing the different stages or phases of the project. This local institution does not cover the borrowing entity and its organization alone, but it includes the entire management that goes into the project along with its policies and procedures. In a broad sense, the institutional set up also incorporates the whole range of government policies and procedures. Experience shows that insufficient attention to the institutional aspects creates serious problems during the implementation and operations phases of the project.

Financial Module

This module provides the first integration of financial and technical variables estimated in the marketing, technical and manpower modules. A cash flow profile of the project is constructed, which identifies all the receipts and expenditures that are expected to occur during the lifetime of the project. An attempt should be made at this stage to provide a description of the financial flows of the project that identifies the key variables to be used as input data in the economic and social appraisal.

The financial appraisal also helps in determining the level and structure of prices or user fees to

be charged from the beneficiaries in order to ensure the project's financial viability. If the facility is publicly owned and provides some basic service, this question becomes more important. Sometimes governments decide to subsidize specific services to consumers as a matter of policy or pure expediency. The recovery of user charges has to take into account the income level of the beneficiaries and the practical problems of administering a particular system. The degree of fiscal impact of such government policies on the budget has a strong bearing on the viability and sustainability of the project. In such cases, not only should the level and structure of prices be defined but also the procedure for making future adjustments in prices and government subsidy should be clearly laid down.

In essence, a distributional analysis combines the financial analysis for each group with its corresponding externalities. The sum of the financial outcome and the externalities generated across the various groups should add up to the economic analysis of the overall project.

For instance, in an irrigation project the policy and procedure for recovering the investment and operating costs from farmers or water users is a matter of concern to the financing agencies including foreign donors and international agencies. Costs in this case may be recovered in a variety of ways: user charges from beneficiaries based on volume of use or area under irrigation, general taxation or requiring the farmers to sell all or part of their produce to a government marketing agency at a price controlled by the government. Each particular policy will have different implications for the level and efficiency of cost recovery and the ultimate financial viability of the project.

The financial module should answer a series of questions concerning the financial prospects and viability of the project.

i. What degrees of certainty do we place on each of the revenue and cost items in the financial analysis? What factors are expected to affect these variables?

ii. In case of public utilities or services provided by a public enterprise, what should be the level of user charges to ensure the project's financial viability and what would be the necessary process and frequency of its revision?

iii. What sources of financing will be used to cover the cost of the project? Does this financing have special features, such as subsidized interest rates, grants, foreign equity or loans (tied or general)?

iv. Is there provision for adequate working capital in the project? Will internal revenues be enough for this purpose or will separate institutional funds be required?

v. What is the minimum net cash flow required by this investment to be able to continue operations without unplanned requests being made to the government treasury for supplementary financing?

vi. Does the project have a large enough net cash flow or financial rate of return for it to be financially viable? If not, what sources of additional funds are available and can be committed to the project if it is economically and socially justified but financially poor?

If any one of these questions points to future difficulties, then necessary adjustments should be made in either the design or the financing of the project to avoid problems in future that may adversely affect the project.

Economic Module

It examines the project from the entire economy's point of view to determine whether or not its implementation will improve the economic welfare of the country, the state or the region. An economic appraisal is of exactly the same nature as the financial analysis except that now the benefits and costs are measured from the point of view of the whole economic entity, which could be the country, the state or a specific region. Instead of relying on market prices to measure expenditures and costs as in the case of a financial appraisal, the economic analysis requires the use of techniques to determine the economic prices of goods and service, foreign exchange, cost of capital and labor. The true economic values of costs and benefits are not reflected in market prices in the presence of various distortions such as trade restrictions, price control, taxes, subsidies, and minimum wages.

Some of the elements of project costs and benefits such as environmental pollution, better health and education facilities, manpower training may not be easy to quantify. The best approach in such cases would be to find people's willingness to pay for the service or their willingness to pay for avoiding a negative outcome. The willingness to pay also provides a valuable benchmark for determining the financial level of user charges for services. The financial charges may be raised to the level of the economic prices because the latter indicate the benefit that people derive from the good or service in question and their willingness to pay for the same. It is, however, not always easy to get a measure of the willingness to pay. In some cases, it may be possible to have proxies that help measure people's willingness to pay and thereby estimate the value of a service to the economy.

The questions covering the economic appraisal of a project are as follows.

i. What are the magnitudes of the differences between the financial and economic values of variables that are affected by government regulation and control or are subject to taxes, tariffs, and subsidies?

ii. What are the magnitudes of the differences between the financial and economic values of variables that are affected by other imperfections in the factor and product markets (e.g., labor unions and restrictive trade practices)?

iii. When evaluated at a discount rate that reflects the relevant cost of capital to the economy as a whole, does this project produce a positive net present value?

Social Appraisal or Distributive and Basic Needs Analysis

This deals with the identification and quantification, whenever possible, of the impacts on the various stakeholders of the project. These include impact on the well being of particular groups in society. While this aspect of the appraisal may be less precise than the financial or economic analyses of a project, the social evaluation will generally be tied to the same factors that make up the financial and economic appraisals. For example, a project cannot be expected to assist consumers unless it increases the supply of a good or service at a price not greater than its previous price.

The social appraisal of a project may be organized into two parts; first, estimating how income changes caused by the project are distributed among the various stakeholders to the project (distributional analysis) and second,

identifying the impact of the project on the basic needs in society (basic needs analysis). In conducting a distributive analysis, the net impact of all externalities, which is the difference between the real economic values of resource flows and their real financial values, are measured for each market in present value terms and allocated across various stakeholders of the project. Finally, additional net benefits are attributed to the project if it provides for one or more of the basic needs. For instance, a road project in a rural area not only reduces transportation costs but it may also allow the children to attend school and the sick to get better health care. Both these aspects are viewed positively by society and a social net benefit should be attributed to the project to account for this externality.

The scope of ex-post appraisal is much wider than an audit. The audit has an important function and it should be conducted immediately after the construction phase is over and a completion report is submitted.

Nature of Distributive Analysis

In essence, a distributional analysis combines the financial analysis for each group with its corresponding externalities. The sum of the financial outcome and the externalities generated across the various groups should add up to the economic analysis of the overall project. In this way, it is possible to identify those groups that gain and those that lose and the extent of gain and loss as a result of a project. It provides a very valuable input to the policy makers.

Nature of Basic Needs Analysis

The basic needs externality can be thought of as the price that society is willing to pay for any increases in the recipients' consumption of particular goods or services that contribute to the fulfillment of basic needs. The willingness to pay of donor citizens for basic needs can be added vertically to the private demand curve of the target group to create a social demand curve.

An illustrative set of questions to be asked while undertaking a social appraisal of a project is as follows:

- What social objective could the project assist in attaining?
- Who are the beneficiaries of the project and who is expected to bear the costs?
- In what alternative ways and at what costs could the government obtain social results similar to those expected from this project?
- What are the (net) economic costs of undertaking these alternative projects or programs and is the project relatively cost-effective in generation of desirable social impacts?
- What are the basic needs of the society that are relevant in the country and what impact will the project have on basic needs.

Use of Secondary Data in the Prefeasibility Phase

Whenever possible, the prefeasibility study should utilize secondary research data. Most technical and marketing problems have been faced and solved before by others; therefore, a great deal of information can be obtained quickly and cheaply if the existing sources are utilized efficiently. Secondary research is probably most useful in the technical and engineering modules but less valuable in the

marketing and the manpower and administrative support modules. Marketing and administrative support modules generally require information that is specific to the project and may require some primary data.

Engineering firms and technical experts in the field usually have considerable experience in other projects that have used either identical or similar technology. Often there is a number of consulting firms or government agencies that have technical expertise in a specific area. Utilization of the published research materials on commodities and technical aspects of projects from international organizations and institutions or associations disseminating pertinent information is essential.

Feasibility Study and Financing Negotiations

After completing all the modules of the prefeasibility phase, the project must be examined to see if it shows promise of meeting the financial, economic, and social criteria that the government has set for investment expenditures. It is at the end of this stage that the most important decision has to be made as to whether the project should be approved. It is much more difficult to stop a bad project after the detailed and, often, expensive design work has been carried out at the next stage of project development. Once sizable resources have been committed to prepare the detailed technical and financial design of a project, it takes very courageous public servants and politicians to admit that it was a bad idea.

If the outcome of the feasibility study is such that the decision-makers give their approval to the project, then the next major steps are tying up the financing and developing the detailed project design. Negotiations about the financing of the project have to be finalized with all the financial institutions and a detailed loan document drawn. The drafting and negotiation of the legal documents are essential for ensuring that the borrower and the lenders are in agreement not only on the terms of financing but also on the broad objectives of the project and the detailed schedule and specific activities necessary for implementing it.

Detailed Design

Preliminary design criteria must be established when the project is identified and appraised but usually expenditures on detailed technical specifications are not warranted at that time. Once it has been determined that the project will continue, the design task should be completed in more detail. It involves detailing the basic programs, allocating tasks, determining resources and setting down in operational form the functions to be carried out along with their priorities. Technical requirements, such as manpower needs by skill class, should be finalized at this stage. Upon completion of the blueprints and specifications for construction of facilities and equipment, operating plans and schedules along with contingency plans must be prepared and brought together before going into the implementation phase.

When this process is completed, the project is again reviewed to see whether it still meets the criteria for approval and implementation. If it does not, then this result must be passed on to the appropriate authorities for final disapproval or rejection of the project.

Project Implementation

If the appraisal and design have been properly

executed and negotiations to finalize the conditions for financing successfully completed, the formal approval of the project is sought from the competent authority. The formal approval will require the acceptance of funding proposals and agreement on contract documents, including tenders and other contracts requiring the commitment of resources.

The next stage in the project's life cycle is its actual implementation. This is, evidently, the most important part of the project cycle. The project implementation phase covers both the completion of construction activities and the subsequent operations and is generally divided into three different time periods. First is the investment period when the major project investments take place. Second is the development period when the production capacity gradually builds up. The final phase is that of full operations. Implementation is a dynamic process in which every one involved with the project has to constantly respond to new problems or changing circumstances that may affect the project's outcome.

The process of implementation involves the coordination and allocation of resources to make the project operational. The project manager has to bring together a project team including professionals and technicians. This team will, in turn, have to coordinate with the various consultants, contractors, suppliers and other interested agencies involved in putting the project in place.

Responsibility and authority for executing the project must be clearly assigned. This will include the granting of authority to make decisions in areas related to personnel, legal and financial matters, organization and administration. Proper planning at this stage is essential to ensure that undue delays do not occur and that proper administrative procedures are designed for the smooth coordination of the activities required for the implementation of the project.

A system of monitoring and supervision has to be evolved for completing this phase successfully and on time. This task is very important because all projects face some implementation problems. The problems may arise either because of some flaw or shortcoming in the planning of the project or simply because of changes in the economic and political environment. The monitoring takes place at various levels. The first and the foremost level is the monitoring by the project manager and his team. This is done almost on a daily basis. Again, there is periodic monitoring by the higher management levels in the department or the implementing agency and also by the concerned ministries in the government. Different sets of criteria have to be evolved for monitoring by the different levels of supervisors within the organization and outside.

Ex Post Appraisal and Evaluation

Historically, considerably more resources have been spent on the preevaluation of projects than on the review of the projects actually implemented. For the development of the operational techniques of project appraisal and the improvements in the accuracy of evaluations, it is very useful to compare the predicted performance with the actual performance of projects. In order that this review of the strengths and weaknesses of implemented projects be of maximum value to both policy makers and project analysts, it is important that some degree of continuity of

personnel be maintained within the project evaluation teams through time.

In carrying out ex post appraisal, both elements of success and failure are systematically analyzed. It need not be conducted only for completed projects, but may take place at various stages during the project's implementation and operational phase. A careful appraisal of a project is a must before planning any follow up projects. A final detailed ex-post appraisal should, of course, be undertaken after the project is terminated.

To facilitate this type of appraisal, a review of the administrative aspects of the project development should be made immediately after the project becomes operational. The managers of the operational phase of the project should be made aware of the fact that an in depth appraisal of the project's performance is to be carried out. This ensures the development of necessary data from an early stage and makes the appraisal process quite cost-effective.

The scope of ex-post appraisal is much wider than an audit. The audit has an important function and it should be conducted immediately after the construction phase is over and a completion report is submitted. The project's outcome (net present value or internal rate of return) should be reestimated on the basis of the actual investment costs and the updated costs of maintenance and operations. This, however, is not sufficient to enable the project management, the government department or the parent agency to draw meaningful lessons for design and preparation of future projects.

The function of the post appraisal is not only to assess the performance of a project and give an ultimate verdict as to its overall contribution to the state's development, but also to identify the critical variables in the design and implementation of a project that determined its success or failure. It is expected that well considered recommendations would emerge from the appraisal about improving each aspect of the project design and its actual implementation. Based on such appraisal, ongoing projects may be modified and subsequent projects in the sector can be improved from the experience of completed projects. Also, new policies, better management practices and improved procedures can be adopted to improve project performance in general.

Ex post appraisal may be done by different people who are directly or indirectly involved with the project. The project management, the sponsoring government department or agency, the operating ministry, the planning organization in the government or an external aid agency may be interested in the process. Each of these agents has its own lessons to draw from different aspects of the project. For instance, in an irrigation project, the immediate management is primarily concerned with the physical performance of the project. The sponsoring agency, which will be the department of irrigation, is worried about the cost and time overrun, the appropriateness of the technology adopted and the suitability of the institutional and managerial arrangements. The controlling ministry would be interested in keeping the project within the limits of time and budget.

It would also like to know whether the long-term objectives of the project are realized. The planning department's concerns will be similar to those of the controlling ministry. In addition, it would be interested in evaluating the project's impact on the well-being of the people of the region and finding how well it fits into the overall development strategy of the country or the region. Finally, the aid agencies want to know whether the project meets their stated goals for the country or the region.

Finally, the evaluation of a project involves an assessment of the outcomes of a project or its impact on the beneficiaries rather than simply the measurement of the outputs of the project. For instance, while the appraisal of an irrigation project would involve an analysis of costs and benefits to the various stakeholders who are involved in constructing the irrigation system, the evaluation would imply the study of change in agriculture productivity in the region. Similarly, the evaluation of a school may involve an estimation of its impact on literacy in the region rather than simply looking at the number of school going children. Thus the project evaluation would often include pre- and post-project benchmark surveys to see how the project has been able to achieve its overall objectives.

Part 3: Project Evaluation Framework

Integrated Project Analysis

Traditional approaches to the appraisal of investment projects have tended to undertake the economic analysis in isolation from the financial analysis, thus ignoring the interaction of the financial and economic outcomes. It is quite common to find that the impact of possible changes in the economic policy environment has not been factored into the design of the project and the assessment of its risk. Consequently, analysts have generally failed to identify and make provisions for policy and institutional variables that are important determinants of the sustainability of many of these investments. The economic distortions that financially subsidize a project, when removed, often become a major source of failure for these investments. Reduction in the level of trade protection is a well-known example of this problem.

The Integrated Project Analysis adopted in this Guidebook expands the scope of the analyses of both public and private sector projects beyond the traditional practice of decision making on the basis of the financial and economic net present values of an investment. It demonstrates that if the economic and financial analyses are carried out using a common *numeraire*, preferably expressing all values in terms of the domestic prices at the domestic price level, the scope of the analysis can be expanded to include issues of stakeholder impacts, poverty impacts, and an assessment of the long-term sustainability of the project. Instead of just providing summary statistics of the financial and economic net present values for the project, we are now able to assess the income impacts that the project will have on different interest groups in society.

An important contribution of this analysis is that it forces the analyst to do a reconciliation of the economic performance, the financial performance and the distributional impacts of a project. If the economic and financial analyses of a project have been done consistently, the distributional stakeholder analysis is a relatively straightforward outcome. The benefit of such an extension of the analysis is very important for assessing the political-economic dimensions of public sector investments. The need for identifying the project's stakeholders, the groups who will benefit from the project and those who will lose, is crucial. A project's likelihood of successful implementation or long term sustainability is likely to be threatened if specific groups in society are unwittingly hurt by it. In many cases, the most important factor determining a project's sustainability is its impact on the government budget. For sustainability, the project's fiscal impact must be consistent with the ability of the public sector to finance such activities.

To undertake an integrated financial, economic and distributive investment appraisal or to evaluate the sustainability of a project, two steps need to be taken:

(a) First, the project's financial profile should be compared on a period-by-period basis and not just summarized in single statistics such as the NPV or the internal rate of return (IRR). Such summary criteria examined in isolation do not accurately assess the sustainability of a project or its riskiness. Consider a project that has both a large financial internal rate of return (FIRR) and a large positive NPV, but also has negative financial cash flows in the early years of its life. Such a project may go bankrupt, jeopardizing its economic

performance, long before it has a chance to generate the large positive net cash flows expected in later years. It is the examination of the cash flows year by year over the project's lifetime that will give the analyst an indication of the sustainability and financial riskiness of the project. If a project is not financially feasible on its own, then a realistic assessment of the degree of budgetary support that it is likely to receive from the government needs to be made.

(b) Second, the financial and economic analyses must be expressed in the same unit of account. If we do not use the same *numeraire* we cannot successfully investigate the differences between financial and economic values of inputs and outputs. If the units of account are different for financial analysis and economic analysis, then the differences between the economic and financial values have no significance or meaning. In the literature on benefit-cost analysis, the three common choices for the *numeraire* are: domestic currency at domestic price level, domestic currency at the border price level, and foreign currency at the border price level.

Financial analysis is usually performed in domestic prices at the domestic price level because these are the currency and the price levels in which the markets of the country operate. Therefore, the use of any other *numeraire* quickly diminishes the level of understanding that decision-makers will derive from the analysis. Analysts, who want to take an integrated approach in examining the risk, sustainability and distributional impacts of a project, usually find it much easier to work with domestic prices at the domestic price level so that the economic analysis and financial analysis of a project can be readily compared. This is the *numeraire* used in this Guidebook and thus the entire analysis is in domestic prices.

The Integrated Project Analysis adopted in this Guidebook expands the scope of the analyses of both public and private sector projects beyond the traditional practice of decision making on the basis of the financial and economic net present values of an investment.

Financial Analysis

The cash flows that are available to both equity owners and debt-holders are the expected incremental net cash flows to *total* capital. A project likely to be attractive to all investors only if the NPV of the incremental net cash flows to total capital is positive.

If the company proposing a project appears to be stable, but the project does not yield the private investors a sufficient (or required) rate of return, then a related function of the financial analysis is to measure the minimum amount of incentive or assistance that would be needed to induce the private investors to undertake the investment (i.e., the amount needed to bring the NPV from a negative amount to zero). This is the reason why the financial analysis is one of the cornerstones of the methodology for determining the amount of budgetary support needed for a public sector project or the government financial assistance or contractual, partnership or regulatory arrangement required for the private sector to undertake the investment.

Generally, in the financial analysis there are two perspectives on the financial flows. The first is

the so-called free cash flows to the total investment. It is out of these cash flows that the different financiers will have to recover their investments. Debt holders in particular are interested in whether the free cash flows offer them a sufficient margin of safety to cover the debt repayment schedules.

The other perspective is that of the equity holder or project sponsor who receives the residual cash flows after the debt holders have been repaid. These net cash flows have to be sufficient to recover the equity holder's capital investment. This perspective is critical in all private sector projects as well as all public projects that expect to cover their costs through user charges or for all public private partnership arrangements.

In all other nonself-financing projects with little or no user charges being collected, the financial viability of the project depends upon the estimation of future availability of general public sector revenues. Table 3.1 is provided to help sensitize the project analyst to the different roles of financial analysis for self-financing and nonself-financing projects.

The building blocks for the financial analysis of a project are as follows:

Investment Plan

- Combines information from the *market* and *technical* ***analyses*** to establish a detailed plan for annual incremental expected capital expenditures during a project's investment

Table 3.1: Key Characteristics of Financial Analysis of Self-financing and Nonself-financing Projects

	Self-financing Investment Projects	Nonself-financing Projects
Source of payment of operational expenses and financing costs	Sales revenue has to cover all costs	Exogenous finances such as government tax revenues have to cover any balance of operational expenses and financing costs
Key forecasts to assure project finances	Market demand and sales revenues	Tax revenue forecast
Key source of economic benefits	Market demand	User benefits (with or without user charges)
Typical projects	1. Private sector projects 2. User-financed public projects 3. Public-Private Partnerships	Public sector projects (with no or low user charges) such as public infrastructure or social services
Key financial analysis questions	1. Is investment financially attractive to equity holders? 2. Are the free cash flows from the total investment sufficient to cover the debt repayment at an acceptable level of default risk?	1. Can adequate debt and revenue financing be raised to cover capital investment expenditures? 2. Will sufficient revenues be available over the future years to cover operational costs and debt repayments?
Derivation of economic benefits of project	Economic benefits are found directly from private market demand	Separate analysis required of the net benefits derived by users of public project — for example, farmers gains from irrigation or rural roads

phase. Capital expenditures include expenditures on land, buildings, machinery, equipment, building materials, and construction and management labor;

- Should provide estimates of the liquidation or scrap value of all major fixed assets and the value of net working capital at the end of a project's life;
- Should disaggregate expenditures on machinery, equipment, and building materials into tradable and nontradable commodities; and
- Should indicate the breakdown of workers by skill and likely sources of availability.

Operating Plan

- Combines information from the market and technical analyses to establish a detailed plan for the operating phase of a project.
- Should provide projections of expected sales revenues and expected operating costs for each year during the operating phase. Operating costs include operating material inputs and operating labor.
- Should forecast annual net working capital requirements.
- Should also specify the management and operating manpower requirements by skill and source of availability for each year of the operating phase.
- Should disaggregate material inputs into tradable and nontradable commodities.

Financing Plan

- Should provide details about how any anticipated negative net cash flows will be financed during both the investment and operating phases of a project.
- Equity investors should be identified and the anticipated timing of their contributions should be specified; dividend policy, if any, should also be stated.
- Debt holders should be identified and the anticipated timing of their contributions should be specified; interest and amortization schedules should also be stated.

These financial data can be combined in the manner described to determine whether a project is financially viable and attractive to investors.

Financial Attractiveness

There are various criteria that can be used to judge the financial attractiveness of an investment opportunity. These include the net present value (NPV) criterion, the internal rate of return (IRR) criterion, the payback period, and benefit-cost ratios. The strengths and weaknesses of these criteria are reviewed below.

Economic Analysis

The starting point for the economic analysis is the expected incremental net cash flows to total capital from the financial analysis. When there are perfectly competitive, undistorted markets (for closely related commodities), and there are no other reasons for economic externalities to exist, market prices will provide a reasonable measure of marginal economic benefits or marginal economic costs. Under these conditions, and where a project introduces only small changes in the demand for its inputs and in the supply of its outputs, the financial analysis could serve as a proxy for the economic analysis.

When these requirements are not satisfied, however, then market prices no longer provide a

reliable measure of marginal economic benefits or costs. The broader perspective taken by the economic analysis requires that a series of adjustments be made to convert estimates of incremental cash receipts into incremental economic benefits and estimates of incremental cash disbursements into incremental economic costs. These adjustments are based on Harberger's three basic postulates for applied welfare economics, which can be used to measure economic benefits and costs and then to add them up, summarized in three principles: willingness to pay represents the project's benefits, supply price measures the cost of production, and "a rupee is a rupee no matter who receives it or who pays it."

The market distortions referred to above fall into the broad category of externalities. In a nutshell, these distortions or externalities comprise of taxes, subsidies, trade tariffs, price controls, monopoly markets, environmental impacts such as pollution or congestion, and open access or common property situations. Again, we come across these externalities in estimating the price of capital (discount rate) because of imperfect capital markets and the price of foreign exchange because of trade distortions and controls in the foreign exchange markets. Similarly, there may be distortions in the labor market where the financial wage rate may be different from the economic price of labor because of taxes, minimum wage rules and other imperfections in the labor market.

In the case of private sector projects or other self-sustaining projects such as public sector investments expecting to recover their costs from user charges (such as is the case with public private partnerships), the economic benefits can be found from the market demand

The broader perspective taken by the economic analysis requires that a series of adjustments be made to convert estimates of incremental cash receipts into incremental economic benefits and estimates of incremental cash disbursements into incremental economic costs.

for the project outputs adjusting for the externalities in this and related markets. By contrast, for nonself-sustaining projects such as a public road, the economic benefits are all external to the project financial accounts. Essentially in such cases a separate financial and economic analysis is required of the benefit derived by the user. This is commonly done, for example, to estimate the benefits that farmers may derive from a new irrigation scheme or new rural road. This difference is noted in Table 3.1.

The impact of a project on other industries or sectors is also of importance to its economic analysis since industries producing close complementary or substitute products may experience demand or supply changes as a result of a project. In particular, industries producing close complements to a project's output are likely to experience an increase in demand whereas those producing close substitutes are likely to experience a decrease in demand. If the markets for these products are also distorted due to congestion, pollution, taxes, or subsidies etc., then additional economic externalities will arise. Also, the cost of producing these related products could be affected if a project introduces a technological innovation that lowers costs (a technological externality). These externalities should be incorporated into the economic analysis of a project.

The economic analysis is a key determinant of whether a project should receive government

financial assistance. Only a project with a positive NPV of incremental net economic benefits should qualify for approval and/or financial assistance.

Distributional Analysis

The distributional analysis, also referred to as stakeholders' analysis, deals with income changes that are brought about as a result of the project. This part of the analysis asks the following question: who will benefit from the project and by how much and who will lose or will pay for the project and by how much? Both the financial and economic analyses have to be completed before the distributional impacts can be determined.

This Guidebook does not attempt to attach different values to the benefits received by different income groups. Instead, the procedure adopted is based on Harberger's third basic postulate that treats a rupee as a rupee no matter to whom it accrues, and therefore, adds up the costs and benefits without regard to which person receive them.

The prices of inputs and outputs, wages, rate of inflation, and exchange rate are all crucial for projecting future cash flows and it is not known how their values will vary over the life of the project.

The use of distributional weights could lead to misleading conclusions and possibly an artificial restructuring of the project. Assigning weights for various subgroups in the economy could mean that the attractiveness of the project is dependent on how it is financed. This would necessitate not only the analysis of the project's incremental benefits and costs but also of the various tax increases which could be used to finance it. Clearly, this would complicate the evaluation of the project.

A distributional analysis combines a financial analysis along with the corresponding externalities affecting each group. The sum of these analyses across the various income groups should add up to the economic analysis of the overall project. In this way, it is possible to identify those groups that gain and those that lose as a result of a project.

Risk Analysis

Like everyone else, project analysts simply do not know with certainty what will happen in the future. Hence, the forecasts that are used in the market, technical, financial, economic and distributional analyses are all made under conditions of uncertainty. The prices of inputs and outputs, wages, rate of inflation, and exchange rate are all crucial for projecting future cash flows and it is not known how their values will vary over the life of the project. As such, the single valued outcome (NPV, IRR) of the financial analysis will not be accurate or meaningful. As the economic and distributive analyses are based on the financial cash flows, their outcomes will also suffer from the same shortcoming. It is no exaggeration to say that the only thing known with certainty about the outcome of project analysis is that the numbers emerging from it will never be attained when the project is actually implemented.

Since many of the parameters are uncertain, the results of financial, economic and distributional analyses in terms of the selection criterion (IRR or NPV), the cash flows and the externalities will yield only one of the several probable values. What is required is a distribution of values of

these outcomes that incorporate all the possible values that the various parameters may assume. When there is no information about likely probability distributions of prices and quantities, it is necessary to make informed guesses about future values of a project's variables. In other cases when some knowledge of probability distributions is available, it will be possible to calculate the *expected values* of the variables, or to make projections based on past data that take account of the historical means and variances of the variables. The topic of risk analysis provides the methodology for dealing with uncertainty when there is some knowledge of probability distributions.

To begin with, a sensitivity analysis tells us which parameters are significant for the outcome of the project. These become risk variables. Other parameters that do not matter much may be ignored. For each risk variable, a probability distribution and range of values is assigned. Correlations among variables are also built into the model. Finally, a Monte Carlo simulation is performed and the model results are analyzed. What the risk analysis yields is not a single number but a distribution of results, such as expected values of the desired outcomes, the probabilities of negative returns and the variability of outcomes. Risk analysis is then extended to economic and distributive analyses. The results of the risk analysis enable the decision makers to make a more informed decision about project selection.

To manage risk a way must be found to redesign or reorganize a project in order to reallocate risk efficiently. This requires not simply a cost perspective, where the aim is to reduce risk to one party by shifting it on to others — clearly a zero-sum game — but rather an efficiency perspective, where with the right contracts one party can gain substantially without corresponding costs to other parties. The solution is to reallocate risk to those parties who can best bear it.

Part 4: Project Evaluation Framework: Schematic Diagram

This schematic diagram of project evaluation framework is based on a hypothetical power project.

Basic Facts:

- The utility authority of the county currently operates two dams, and a thermal power plant (installed capacity of 912, 160 and 30 MW, respectively);
- The utility authority proposes to build a third dam to meet the increasing domestic and foreign demand of electricity on the system. The dam will be located about 150 km north of a lake;
- The expected annual amount of electricity generated is 1150 GWh. Part of the energy generated will be exported to the neighboring countries;
- The total project cost (at 1996 price level) is estimated at 310 million USD 79 percent and 21 percent of the total cost are in foreign and domestic currency, respectively;
- Foreign component of investment cost is financed with a subsidized foreign loan; and
- Tariff rates charged to main domestic and foreign clients have remained unchanged for years. Under a contractual arrangement with foreign clients, tariff rates are adjusted for

Figure 4.1

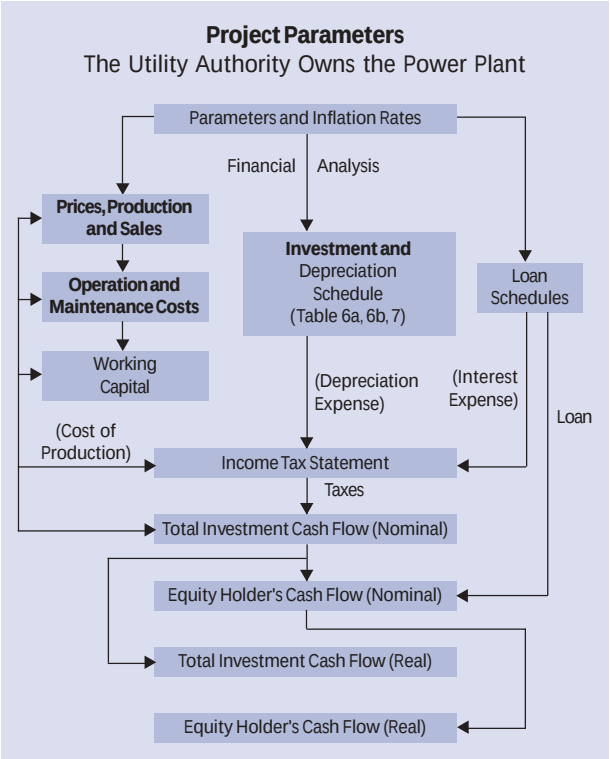


Figure 4.2

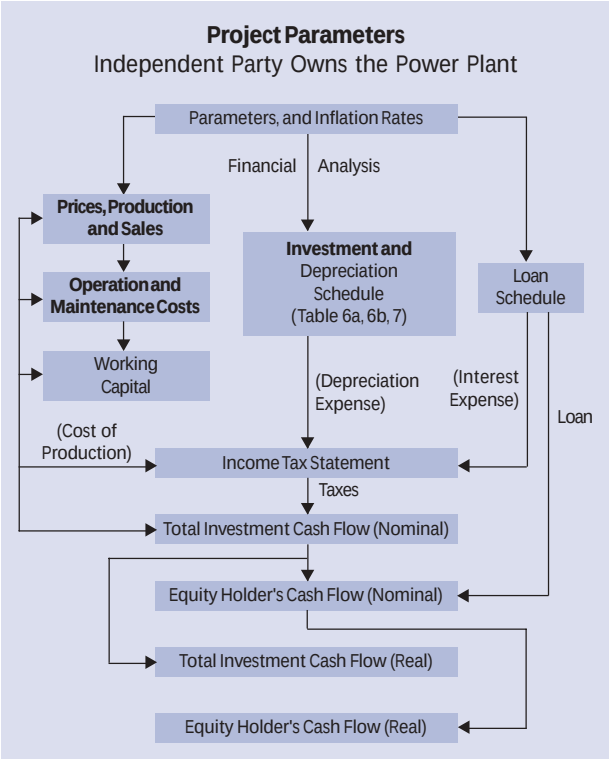


Figure 4.3

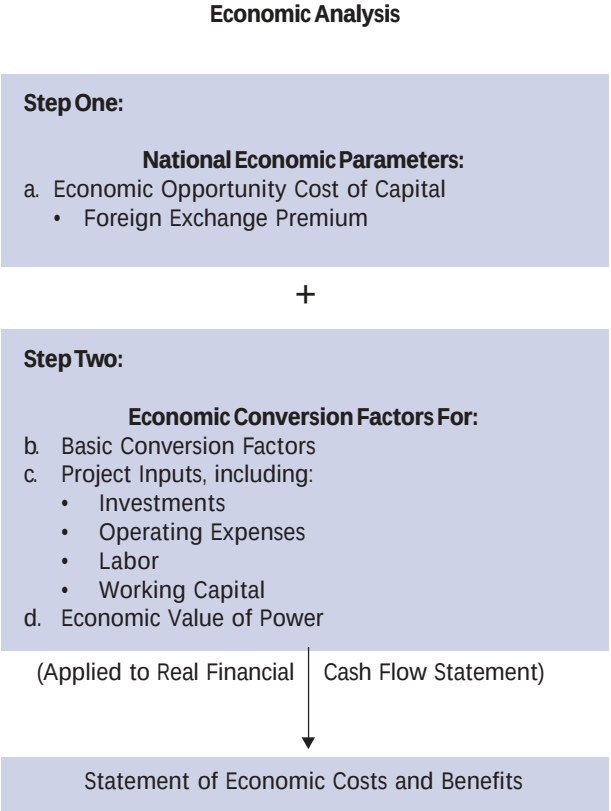
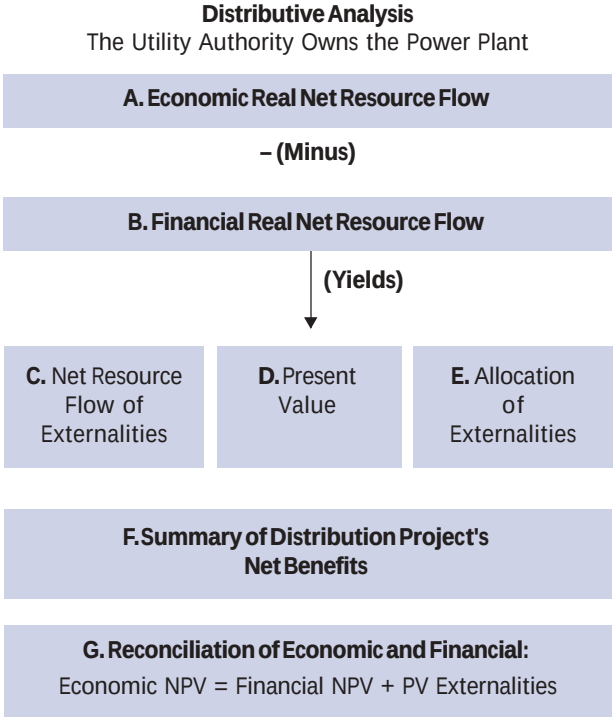


Figure 4.4



inflation every five years.

Project Outcomes:

- Under the current tariff policy, the project is not viable from the financial viewpoint. The net present values are — 44 and —174 billion in domestic currency when the utility or an independent power project undertakes the project respectively;
- Different tariff rates, which take into account the construction cost of the hydro plant makes the project financially viable from the equity holder's point of view. It is recommended to negotiate a faster adjustment of nominal tariffs with domestic customers; and
- Project is highly attractive from the economic point of view (NPV equals to 72 billion of domestic currency), with a 10 percent probability of negative economic outcome.

Figure 4.5

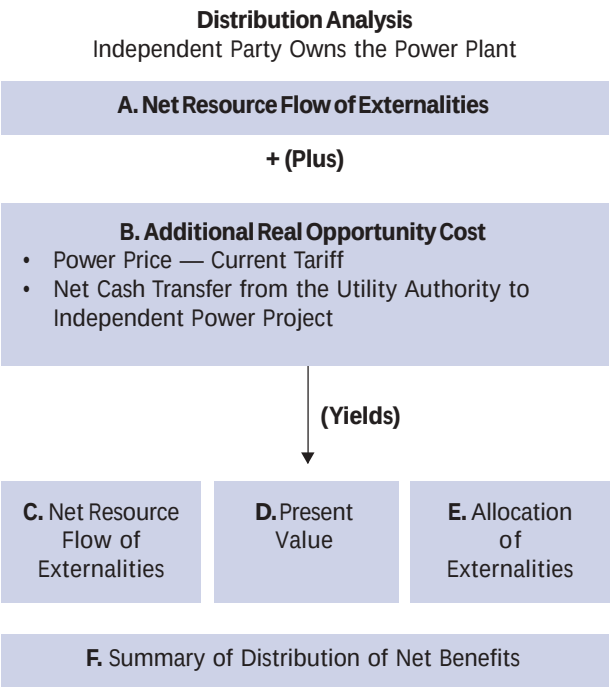


Figure 4.6

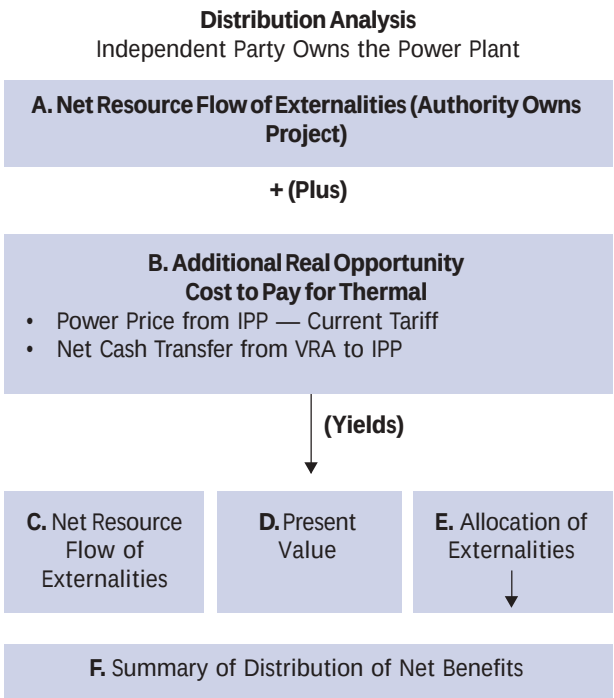
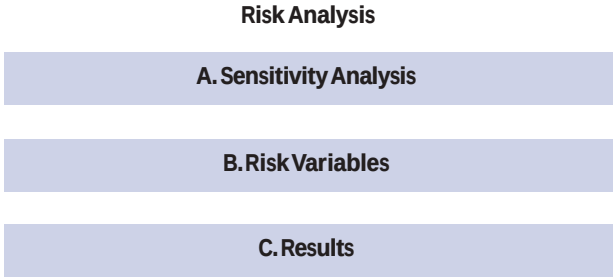


Figure 4.7



Part 5: Project Evaluation Criteria

Introduction

As mentioned in the previous Part, the financial attractiveness of a project is determined by the net present value (NPV) of its expected incremental net cash flows and the economic desirability is measured by the NPV of its incremental net economic benefits. The NPV criterion is widely accepted by accountants, financial analysts, and economists as the only criterion that yields correct project choice in all circumstances. However, some private investors and public sector agencies have frequently relied upon other criteria such as a project's internal rate of return (IRR) or a benefit-cost ratio; some have used a payback period criterion. The strengths and weaknesses of these criteria are examined in this Part in order to demonstrate why the NPV criterion is the most reliable one for government analysts to use.

Time Dimension of a Project

Investment decisions are fundamentally different from consumption decisions because the former have a time dimension. For example, land and capital equipment are purchased at one point in time, and they are expected to generate net cash flows, or net economic benefits, over a number of subsequent years. To determine whether the investment is worthwhile it is necessary to compare the benefits and costs that occur in different time periods. The problem is that a rupee spent/received today is worth more than a rupee spent/received in a later time period. In other words, it is not possible just to add up the benefits and costs of a project to determine which is larger without first taking account of the fact that rupees spent on investment today are worth more today than the rupees received in benefits in the future.

Expressing the values in terms of either future or present values can capture the time dimension of a project's net cash flows and net economic benefits. When moving forward in time to compute future values, analysts must allow for the *compounding* of cash flows. When bringing future values back to the present for comparison purposes, it is necessary to *discount* them. Discounting is just the inverse of compounding.

Time Value of Money

Time enhances the value of a rupee today and reduces the value of a rupee spent/received in the future. Because individuals consider waiting to be a cost, it is necessary to compensate them for forgoing their consumption today and instead lending their funds to a bank or a borrower. Thus, banks and other financial institutions have to offer interest payments to the lenders to induce them to part temporarily with their funds. If the annual market interest rate were 5 percent, then one rupee today would be worth 1.05 rupees in a year's time. This implies that in equilibrium, lenders value 1.05 rupees in a year's time the same as one rupee today.

Compounding

There are two main ways that interest can be included in future values, simple interest and compound interest. Simple interest is paid on only the principal amount that is invested while compound interest is paid on both the principal and the interest as it accumulates. Over time, compound interest, which is the most commonly used way of charging interest, can cause the future value of 100 rupees invested today to increase by substantially more than simple interest. The difference is due to the interest on the cumulative interest. The formula

for compound interest payment is:

$V_t = V_0 \times (1 + r)^t$,

where, V_t = value in year t, V_0 = value in year 0, r = the interest rate and t = time period.

The interest may be compounded annually. It is not, however, uncommon for interest to be compounded more frequently, e.g., semiannually, quarterly, monthly or even continuously. The number of compounding intervals also affects the future value of an amount of cash invested today. The other two factors that affect the future value of Rupees 100 invested today are the time period of investment and the interest rate.

The net present value (NPV) is the algebraic sum of the present values of the expected incremental positive and negative net cash flows over a project's anticipated lifetime.

When comparing two debt contracts, furthermore, it is essential that they be judged on the basis of equivalent rates — annual rates in the case of most loan agreements, semiannual rates in the case of bonds. The magnitude of the interest rate is certainly a major determinant of future value.

The formula for determining the future value using a constant interest rate is:

$FV = 100*(1 + r)^t$

However, if interest rates were expected to vary over time, then the formula would become:

$FV = 100*(1 + r_1)(1 + r_2)(1 + r_3) \ldots (1 + r_t)$,

where, r_i = the expected interest rate in year i.

If interest rates are expected to increase over time, and if this expectation could be captured in a loan agreement, then its future value would be higher than with a constant rate.

Discounting

The discount factor allows us to compute the present value of a rupee received/paid in the future. Since we are moving backward, rather than forward in time, the discount factor is the inverse of the compound interest factor. At a 10 percent annual discount rate the discount factors are as follows:

Years	0	1	2	50
Discount Factor	$1/(1.1)^0$ = 1.0	$1/(1.1)^1$ = 0.909	$1/(1.1)^2$ = 0.826	$1(1.1)^{50}$ = .0085

The later a cash flow is received or paid, the lower its present value. Thus, 100 rupees received 50 years from now has a value of only rupees 0.85 today at a discount rate of 10 percent.

The magnitude of the discount factor is affected by the same variables as those that determine the magnitude of the compound interest factors. One is the compounding interval.

The annual discount factor is:

$V_0 = V_t/(1 + r)^t = V_t(1 + r)^{-t}$.

The continuous discount factor is:

$V_0 = V_t/e^{rt} = V_t(e^{-rt})$, which is a smaller number.

Besides the timing of the cash flow, the other factor that determines the discount rate is the

level of market interest rates. This is why it is critical to pay careful attention to the estimation of the private and economic discount rates in the financial and economic analyses.

The present value can also be interpreted as the amount that would have to be set aside today in order to have USD 100 at a future date. This is evident from taking the future value of the present value.

The Net Present Value (NPV) Criterion

The net present value (NPV) is the algebraic sum of the present values of the expected incremental positive and negative net cash flows over a project's anticipated lifetime. If this sum is equal to zero, then investors can expect to recover their incremental investment and earn a rate of return on their capital equal to the private discount rate used to compute the present values.[10] However, if the private discount rate is based on the market cost of capital for a project of equivalent risk, as it should be, then investors would be no further ahead with a zero-NPV project than they would have been if they had left the funds in the capital market. Investors are not worse off; they are just not better off.

A NPV greater than zero means that investors can expect not only to recover their capital investment and earn a rate of return equal to the discount rate, but also to receive an addition to their real net worth equal to the positive amount of the NPV. In other words, a positive-NPV project outperforms the capital market and makes investors better off.

Finally, if the NPV is less than zero, then investors cannot expect to earn a rate of return equal to the discount rate, nor possibly to recover their invested capital, and hence, their real net worth is expected to decrease. Only projects with positive NPVs are going to be beneficial and hence attractive to private investors. They are unlikely to pursue a project with a negative NPV unless there are strategic reasons or they receive financial assistance.

The formula for computing the NPV of expected incremental net cash flows over n time periods with annual discounting is:

$$NPV = \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$$

where, the incremental net cash flows (C_i) could be negative, zero, or positive, and r is the discount rate equal to the cost of capital and the sigma sign (Σ) is the symbol for summation. It is today's cost of capital that matters because that is what it either costs to raise the funds or is being forgone as a result of using available funds for a project rather than putting them to work in the capital market.

The NPV formula for the annual net cash flow can be written out in its component present values as follows:

$$\text{NPV} = C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_n}{(1+r)^n}$$

The net present value criterion can be stated in the form of a set of decision rules.

Decision Rule 1: Do not accept any project unless it generates a positive NPV when discounted by a discount rate equal to the opportunity cost of funds.

[10] The recovery of the invested capital is anticipated when because the incremental capital expenditures are included in the initial negative net cash flows.

Decision Rule 2: To maximize net worth, choose among the various projects, or scenarios of projects, the one with the highest NPV. If investment is subject to a budget constraint, then choose the package of projects that maximizes the NPV of the fixed budget.

Decision Rule 3: When there is no budget constraint and when a choice must be made between two or more mutually exclusive projects, *e.g.*, projects being considered for the same building site, then investors who seek to maximize net worth should select the project with the highest NPV.

Rule 3 is stated in terms of the absolute value of the NPV, not in terms of the NPV per rupee of investment. For example, consider two projects, A and B, which are mutually exclusive for technical reasons and have the following characteristics:

Project A: NPV of project A = Rupees 700,000
Present value of capital expenditure = Rupees 4,000,000.

Project B: NPV of project B = Rupees 600,000
Present value of capital expenditure = Rupees 1,500,000.

According to Rule 3, Project A with an overall NPV of Rupees 700,000 should be chosen because it has the higher NPV, even though the NPV per rupee of investment is higher for Project B (0.4) than for Project A (0.175). The reason for choosing Project A is that even though it requires an incremental investment of Rupees 2,500,000, it yields an incremental gain in NPV of Rupees 100,000 over and above a rate of return equal to the discount rate on the incremental investment. By choosing Project B, an investor would have a NPV of Rupees 600,000, and any additional funds are assumed to be invested in the capital market where they would have a zero NPV. Thus, by choosing Project A, an investor would be Rupees 100,000 better off, and Project A is the preferred choice.

Note that even though the NPV of the incremental net cash flows might be negative and a project would not appear attractive to private investors, it may create benefits for others in the form of economic externalities that should be captured in an economic analysis. If the economic benefits are sufficiently large to outweigh the economic costs, then the government, on the grounds of improving economic efficiency, would have reason to offer the private investors some financial assistance to make the project more attractive to them.

Investment projects can exhibit different time profiles for the expected incremental net cash flow either to total or equity capital over a project's life. For example, the figure below shows time profiles for three types of investment projects, namely:

1. The investment expenditures initially cause the net cash flow to be negative, but once the expenditure is incurred the rest of the net cash flows are expected to be positive over the project's life;
2. This profile is slightly different because after a few years of operations, the replacement of some of the project's machinery and equipment causes the net cash flow to become temporarily negative; and
3. The last profile also turns negative, but in this case it is due to a major expenditure at the end of a project, e.g., environmental

regulations require a strip-mining site to be restored to its original condition. The criterion used to appraise investment projects must be applicable to any time profile of net cash flows. Unlike other possible criteria, the net present value criterion is the only one that meets this requirement.

Although the NPV criterion is used by large companies and by government agencies, they also use alternative criteria. Each of these alternatives has serious drawbacks compared to the NPV criterion and is therefore judged not only less reliable, but potentially misleading. When two or more criteria are used to appraise a project, there is always a chance that they will point to different conclusions, and a wrong decision could be made. This simply creates unnecessary confusion and possibly mistakes.

A government project analyst should be familiar with the shortcomings of these alternative criteria. Representatives of a government-owned and controlled corporation or a private company can often be quite adamant about the efficacy of their criteria as a basis for investment decisions. Although it is not necessary to tell these financial managers how to make decisions, nevertheless when a government project analyst wants to measure the gain to private investors from undertaking a project, then the NPV criterion should be employed.

Internal Rate of Return (IRR) Criterion

By definition, the IRR is the discount rate (ρ) that sets the NPV = 0 in the following equation:

$$\sum_{j=1}^{n} \frac{C_j}{(1+\rho)^j} - I = 0$$

where, C_j = the incremental net cash flow to total, or equity, capital, I = the initial investment, ρ = the IRR. We have to solve for ρ.

The IRR is mathematically speaking the root of an equation. The equation is based on the time profile of the incremental net cash flows. If the time profile crosses the horizontal axis from negative to positive only once then the root, or IRR, will exist, but it may not be positive.

This definition is consistent with the meaning of a zero NPV as explained in the previous section, namely that investors recover their invested capital and earn a rate of return equal to the discount rate, which is the IRR. The IRR can be calculated either with a hand calculator or on a computer spreadsheet. The internal rate of return criterion can be stated in the form of a set of decision rules.

Decision Rule 1: Do not accept any project unless its IRR is greater than the opportunity cost of the funds. Accept project if $\rho > r$, the opportunity cost of capital; otherwise, reject. The opportunity cost of capital is measured by the expected rate of return offered by other assets equivalent in risk to the project being evaluated.

Decision Rule 2: When a choice must be made between two or more mutually exclusive projects, then investors should select the project with the higher, or highest, IRR.

The problems with IRR criterion are listed below. We shall discuss them in turn.

Problems with the IRR Criterion

1. The IRR may not exist.
2. The IRR may not be unique. There could be multiple IRRs.

3. Do you want $\rho > r$ or $\rho < r$? Is the project like lending or borrowing?
4. Wrong ordering of mutually exclusive projects, *e.g.*, projects of different scale.
5. IRRs are not additive.
6. IRR generally favors projects with shorter lives.
7. IRR is independent of the timing of a project (*i.e.*, a project's start date), whereas NPV is sensitive to timing.

Problem No. 1: The IRR may not exist.
The IRR is mathematically speaking the root of an equation. The equation is based on the time profile of the incremental net cash flows. If the time profile crosses the horizontal axis from negative to positive only once then the root, or IRR, will exist, but it may not be positive. However, if the time profile crosses the axis more than once then there may be more than one root, or there may be no real roots, only imaginary roots. Although this is more of theoretical concern, it is a little disconcerting to know that an investment decision criterion may not have a solution.

Problem No. 2: The IRR may not be unique. There could be multiple IRRs.
The discussion in Problem No. 1 above explains how there could be more than one root, or IRR, when the time profile of the net cash flows crosses the horizontal axis more than once. The possibility of having multiple IRRs can create some very practical decision-making problems.

The IRR is expressed as a rate per rupee of investment and does not indicate on how many rupees that rate can be earned.

Consider an example like Project B that has the following net cash flow in thousands of constant rupees:

Table 5.1: Time Profile of Net Cash Flow for Project B

Time Period	t_0	t_1	t_2	t_3
Net Cash Flows of B	-20	120	-220	120

Project B has IRRs of approximately 0 percent, 100 percent, and 200 percent (i.e., these roots will solve the IRR equation and set the NPV equal to zero). Let us assume that the private opportunity cost of capital is 6 percent. Would we accept this project?

Let us further assume that we are unaware of the foregoing discussion about multiple IRRs and that we have calculated only the IRR of 100 percent. A project with an IRR of 100 percent sounds very attractive, especially compared to the relatively low 6 percent cost of capital. Would we approve the project?

If we did agree to accept the project, the agency would be worse off, and the analysts might lose their jobs. The NPV of Project B calculated at the 6 percent opportunity cost of capital is INR-1.84 thousand. The investors would have been better off leaving their funds in the capital market rather than to invest in Project B.

The reason that Project B has a negative NPV despite an IRR of 100 percent was stated under Problem No. 1. Project B does not provide a stream of 100 percent return in which to invest the positive cash flows like the 120,000 rupees in t_1 so that their compounded value can offset any subsequent negative net cash flows.

It is possible, of course, that we might have calculated the IRR of 0 percent. Since this IRR is less than the cost of capital, we would have applied the IRR criterion and rejected the project. This time we would have been correct, but we would not have known that until we had computed a project's NPV. And if we have the NPV, why would we need the IRR? If word gets around that we have just rejected a project with an IRR of 100 percent, or worse 200 percent, then we are likely going to have to provide more explanations. In the end, the IRR may introduce confusion and could result in costly mistakes.

Problem No. 3: Do you want $\rho > r$ or $\rho < r$? Is the project concerned with lending or borrowing?

Consider a simple, two-period project like K below. The net cash flows are measured in thousands of rupees and the opportunity cost of capital is 10 percent.

Time Period	t_0	t_1	IRR	NPV (at 10%)
Net Cash Flows of K	-1,000	2,000	100%	818

Project K is like lending; there is first a cash outflow followed by a cash inflow. In this case a high IRR is desirable. The IRR exceeds the cost of capital, so according to the criterion we would accept the project, and we would be correct. The NPV is positive and large.

Now, consider a second two-period project like L below. The net cash flows are also measured in thousands of rupees and the opportunity cost of capital is 10 percent.

What is different this time is that Project L is like borrowing; there is first a cash inflow followed by a cash outflow. In this case a low IRR would be desirable. However, if we were to apply the IRR criterion, the IRR exceeds the cost of capital, and so we would accept the project. Unfortunately, we would be in error. The NPV is negative and large (in absolute value), and the agency would be worse off.

Time Period	t_0	t_1	IRR	NPV (at 10%)
Net Cash Flows of L	+1,000	-2,000	100%	-818

In short, the standard IRR criterion gives the wrong decision if a project is similar to borrowing. Since the investment criterion chosen should apply to all projects, not just some, the IRR criterion should not be the preferred criterion.

Problem No. 4: Wrong ordering of mutually exclusive projects, *e.g.*, projects of different scale

The problem of choosing between two or more mutually exclusive projects arises quite frequently. Examples would include two alternative buildings being considered for the same building site, or a new highway that could be constructed in two alternative ways. Whereas the NPV takes explicit account of the scale of the project by means of the investment that is required and the initial negative net cash flows that accompany it, the IRR ignores the differences in scale. The IRR is expressed as a rate per rupee of investment and does not indicate on how many rupees that rate can be earned.

For example, consider two two-period projects (M and N) with different scales of output. Assume that all the net cash flows are measured in thousands of rupees and that the cost of capital is 10 percent.

Time Period	t_0	t_1	IRR	NPV (at 10%)
Net Cash Flows of M	-1,000	+1,500	50%	363
Net Cash Flows of N	-10,000	12,000	20%	909
			MIRR Δ NPV	
Incremental Project	-9,000	10,500	16.7%	546

If Decision Rule 2 of the IRR criterion were applied, then we would choose the project with the higher IRR. In this case that would be Project M. Once again, however, this would be a mistake. The NPV of Project N is Rupees 546 thousand higher.

The problem is that with Project M the *rate* of return is higher, but it is earned on only an investment of Rupees 1,000 whereas with Project N, the *rate* of return is lower, but the rupee return is higher; hence the higher NPV.

Another way to view this problem is to think about how by accepting Project M, the remaining Rupees 9,000 is going to be invested. Lacking anything more concrete, it is best to assume that the Rupees 9,000 is invested in the capital market, where it would have a 10 percent rate of return and a NPV of zero. If instead the Rupees 9,000 were invested in Project N, there would be an additional net benefit of Rupees 546,000 over and above the 10 percent market return. Clearly, Project N is the better alternative. This is also indicated by the *marginal* internal rate of return (MIRR) on the incremental investment of 16.7 percent which is greater than the cost of capital.

Problem No. 5: IRRs are not additive

Larger projects will frequently have a number of separable components. Each of these components should be analyzed on its own merits and then assessed in conjunction with the other components. Since some of the possible components may be mutually exclusive, those separate combinations have to be examined as well.

Take, for example, a larger three-period Project T that has two mutually exclusive projects, 1 and 2, and a third project 3 that has independent net cash flows, but that could be undertaken with either one of the other two. The question is which is the best package? In the Table, all the net cash flows are expressed in thousands of Rupee and the cost of capital is 10 percent; all of the *separate* projects have the same scale of investment.

Our objective is to maximize the NPV of Project T. The question is whether that will occur if we rely on the IRR criterion. According to the latter, Project 3 is the most attractive of the individual projects, and it remains the most attractive even after assessing it in combination with the other two. Hence, based on IRR Decision Rule No. 2, we would select Project 3 by itself.

Time Period	t_0	t_1	t_2	IRR	NPV (at 10%)
Net Cash Flows of 1	-100	0	550	135%	354
Net Cash Flows of 2	-100	225	0	125%	105
Net Cash Flows of 3	-100	450	0	350%	309

Project T Combinations:

Time Period	t_0	t_1	t_2	IRR	NPV (at 10%)
Projects 1 & 3	-200	450	550	213%	663
Projects 2 & 3	-200	675	0	238%	414

By assumption, the net cash flows of Project 3 are independent of the net cash flows of the two

mutually exclusive projects. In other words, there are no complementarities or substitution possibilities that would cause the combined NPVs of either Projects 1 and 3, or 2 and 3, to differ from the sum of their individual NPVs. When either Project 1 or 2 is combined with Project 3, their combined NPV is substantially higher than Project 3 by itself. In fact, Projects 1 and 3 combined would be the best choice with a combined NPV over twice as high as Project 3 alone. Even Projects 2 and 3 combined would have been preferable. Unfortunately, the IRR criterion would *not* have resulted in these choices.

The reason for the problem is that whereas the NPVs are additive, the IRRs are not. When the separate projects were analyzed, they all had the same scale of investment, but the combinations increase the scale of investment and, therefore, should not be ordered according to the IRR criterion. In this case, the larger scale of investment lowers the IRRs of the combinations and makes them appear less attractive. The IRR of Projects 1 & 3 combined is less than the sum of the individual IRRs of Project 1 and Project 3.

Problem No. 6: IRR generally favors projects with shorter lives

Examples of how the IRR is generally higher for shorter-lived projects are provided in the previous table (used for Problem No. 5). Compare Projects 1 and 2. The undiscounted positive net cash flow of Project 1 is twice as high as that of Project 2, except that Project 2's net cash flow occurs one year earlier. Despite the difference in the cash-flow magnitudes, the IRRs are quite close.

Also compare the combinations. The total of the undiscounted positive net cash flows of Projects 1 & 3 is considerably larger than that of Projects 2 & 3. Yet, the IRR of Projects 2 & 3 is higher because the net cash flows occur earlier.

Problem No. 7: IRR is not sensitive to starting time while NPV is

Consider the same project but started at different times.

Alternative A:

Investment costs	=	1,000 in year 0
Benefits	=	1,500 in year 1

Alternative B:

Investment costs	=	1,100 in year 2
Benefits	=	1,670 in year 3

NPVA: $-1{,}000 + 1{,}500/(1.08) = 388.88$
NPVB: $-1{,}100/(1.08)^2 + 1{,}670/(1.08)^3 = 382.6$
Hence, NPVA > NPVB

IRRA: $-1{,}000 + 1{,}500/(1+KA) = 0$
$KA = 0.5$
IRRB: $-1{,}100/(1+KB)^2 + 1{,}670/(1+KB)^3 = 0$
$KB = 0.52$
Hence, KB>KA

Thus, the IRR criterion would prefer project B to A while it will generate a lower net benefit compared to project B.

Benefit-cost Ratio (BCR) Criterion

As its name indicates, the benefit-cost ratio, or what is sometimes referred to as the profitability index, is the ratio of the NPV of the net cash inflows (or economic benefits) to the NPV of the net cash outflows (or economic costs):

$$BCR = \frac{\text{NPV of Net Cash Inflows (or Economic Benefits)}}{\text{NPV of Net Cash Outflows (or Economic Costs)}}$$

The benefit-cost ratio criterion can be stated in the form of a set of decision rules.

The BCR Criterion

Decision Rule 1: Do not accept any project unless its BCR is greater than one. Accept project if BCR > 1; otherwise, reject. The NPVs in both the numerator and the denominator of the ratio should be discounted by the opportunity cost of the funds. The opportunity cost of capital is measured by the expected rate of return offered by other assets equivalent in risk to the project being evaluated.

Decision Rule 2: When a choice must be made between two or more mutually exclusive projects, then investors should select the project with the higher, or highest, BCR.

Many agencies in the state governments have started using the NPV criterion as the main basis for decision-making in the economic analysis of a project, but they have in the past used the BCR and the Economic IRR as indicators of economic desirability. To use the BCR as a measure of financial or economic desirability runs the risk of screening out possible candidate projects according to a faulty criterion. In some instances, worthy candidates could be eliminated from consideration early on based on their BCRs, and in so doing the overall NPV could be lowered unnecessarily. As illustrated below, furthermore, the NPV criterion and the BCR criterion can often draw the opposite conclusion. Using the two criteria together then becomes a source of confusion, and possibly mistakes.

Although the BCR is popular because it is a handy rule of thumb and summary statistic, it does have two major weaknesses, as discussed below:

Problem No. 1: The BCR is sensitive to the definition of costs. Problem of recurring capital costs

When a project profile is drawn, it is not uncommon to have negative net cash flows in some years during the project's life. The question is should these periodic negative net cash flows be included in the capital costs in the denominator or should they be counted as net cash flows (albeit negative) in the numerator. The problem is that the BCR is a ratio. Whereas multiplying or dividing the numerator *and* denominator of a ratio by the *same* number does not alter the size of the ratio, adding or subtracting the *same* number to the numerator *and* denominator of a ratio will alter its magnitude.

Consider two projects, V and W, where Project W has substantial recurring capital costs in comparison to its initial capital costs. All the NPVs of the cash flows (or economic benefits and costs) are measured in thousands of rupees, and the cost of capital is 10 percent.

By applying Decision Rule No. 2 of the BCR criterion to the project with recurring capital costs netted out of net cash *in*flows (the first approach above), Project W appears to be more attractive than Project V. However, when the NPV of recurring capital costs is instead added to the NPV of initial net cash *out*flows (the second approach), then Project V appears to be more attractive than Project W. Which approach is correct?

The answer is that they are both arbitrary and could easily be used indiscriminately by different project analysts. The problem is that decision-makers would not necessarily know which approach is being used, and even if they

did, they would not know which was correct until they examined the NPVs of the two projects. In the above example, Project V is the better project because it has the higher NPV. With the NPV, there is no need to inquire further.

Table 5.2: Project Net Present Value Analyses

	Project V	Project W
NPV of Gross Net Cash *In*flows (or Gross Economic Benefits)	2,000	2,000
NPV of Initial Net Cash *Out*flows (or Initial Capital Costs)	1,200	100
NPV of Recurring Net Cash *Out*flows (or Recurring Capital Costs)	500	1,800
NPV of all Net Cash Flows	300	100

Alternative Approaches:

BCR when the Recurring Capital Costs are Netted Out of the Net Cash *In*flows (or Gross Benefits)	$BCR^V = \frac{2,000 - 500}{1,200} = 1.25$	$BCR^W = \frac{2,000 - 1,800}{100} = 2.00$
BCR when the Recurring Capital Costs are added to the initial Net Cash *Out*flows (or initial Capital Expenditures)	$BCR^V = \frac{2,000}{1,200 + 500} = 1.18$	$BCR^W = \frac{2,000}{1,800 + 100} = 1.05$

Problem No. 2: Wrong ordering of mutually exclusive projects, e.g., projects of different scale

This problem is basically the same as Problem No. 4 with the IRR criterion, namely that the BCR is a measure of return *per* rupee of investment. The BCR does take account of the differences in the scale of investment. As was evident from the example in Problem No. 1 above, the BCR is also very sensitive to the magnitude of the initial investment costs.

Consider another example of three mutually exclusive projects X, Y, and Z; none of these projects has any recurring capital costs. All the NPVs of the cash flows (or economic benefits and costs) are measured in thousands of rupees, and the cost of capital is 10 percent.

Decision Rule No. 2 of the BCR criterion would rank these projects as follows: Project Z > Project X > Project Y. Compare this ranking with the ordering according to their NPVs: Project Y > Project Z > Project X. The reason that Project Y appears to be the least attractive according to the BCRs is that its relatively large initial capital expenditure lowers the return *per* rupee of expenditure. In fact, however, an agency would be better off earning a 0.175 rupee return per rupee of a Rupees 8 million investment (Project Y) rather than a 0.40 rupee return per rupee of a Rupee 1.5 million investment (Project Z).

There are other project selection criteria such as the payback period, the average rate of return on the book value of the investment, which is an accounting, rather than a finance concept, and the modified IRR. All of these criteria have weaknesses relative to the NPV criterion that is recommended by this Guidebook and most textbooks in corporate finance theory. Therefore the alternative criteria are not analyzed here.

Table 5.3: Project Benefit Cost Ratio Analysis

	NPV of Capital Costs	NPV of Net Cash *In*flows	NPV of Project	BCR
Project X	1,000	1,300	300	1.3
Project Y	8,000	9,400	1,400	1.175
Project Z	1,500	2,100	600	1.4

Part 6: The Financial Analysis of a Project

Introduction

The financial analysis of a project helps determine the financial sustainability of the project and its overall success. In its simplest form, one can describe the financial analysis of a project as a process that entails the organization of specific data requirements in certain statements, followed by the application of certain investment criteria to these statements to determine the financial profitability or sustainability of the project. This process requires an understanding of the concepts, principles and common conventions that underlie a correct financial appraisal. Moreover, the understanding of these concepts and principles is important in defining the data requirements for conducting the financial appraisal of the project.

There are several reasons to conduct a financial appraisal for a government project. The most important one is to ensure the availability of funds to finance the project through its investment and operating stages. It has become increasingly clear that while positive economic returns are necessary for the success of the project, they are by no means sufficient reason for its success.

This Part presents the concepts and principles that are necessary to use the data in constructing financial profiles for the project's receipts and expenditures over the project's life. These financial profiles are known as the project's cash flow statements.[11]

This Part is largely a "hands-on" Guidebbok. It presents the concepts and principles underlying a financial analysis, provides illustrations for most of these concepts and offers practical guidelines for the actual construction of a financial cash flow statement and the analysis of these statements. While the bulk of the Part deals with the nuts and bolts of a financial analysis, several annexes provide additional information.

Why a Financial Appraisal for a Public Sector Project?

It may appear that the financial appraisal of a project is only of interest to a private investor who wishes to determine the net financial gain (or loss) resulting from a project. From a country's point of view, a project will increase the country's net wealth if it has net positive *economic* returns. Conversely a project that yields negative economic returns should not be undertaken as it would lower the net wealth of society as a whole. Consequently, one may expect the emphasis of the appraisal of government projects to be on the economic analysis of projects only. Indeed, when appraising projects in the 1960s and 1970s, the emphasis of development institutions was on the economic appraisal only. Why then do we need to conduct the financial appraisal of a public-sector project in addition to its economic analysis and why is more attention being paid to the financial analysis now than in the 1960s and 1970s?

[11] The cash flow statement is the main financial statement used to assess a project's viability. Other financial statements may be also used to assess a project's viability but play different roles. The statement of profit and loss, for example, helps determine a project's net income, and subsequent tax liability, following the accounting rules. Unlike the cash flow statement, the income statement is not concerned with actual cash inflows that pay dividends and outflows that finance expenditures, and help determine the value of the project. Also, the balance sheet and the statement of sources and applications of funds cannot alone determine the viability of a project.

Financial Sustainability

There are several reasons to conduct a financial appraisal for a government project. The most important one is to ensure the availability of funds to finance the project through its investment and operating stages. It has become increasingly clear that while positive economic returns are *necessary* for the success of the project, they are by no means *sufficient* reason for its success. In other words, a project that has high economic returns may very often fail if there are not enough funds to finance the operations of the project.

Examples of development projects with expected high economic returns that have failed due to financial difficulties abound. Water supply projects are typical examples of projects that have large economic benefits due to the large value attached to water, and low financial receipts due to the low water tariffs. If the project is undertaken solely on the basis of the favorable economic analysis with no consideration given to the financial sustainability, the project may very well fail due to lack of funds to maintain the system, and/or service the debt. The reduction in, or lack of, maintenance results in continuously increasing water losses and reduces the anticipated economic benefits of the system. Other examples include projects from energy, transport, and irrigation sectors where services are usually provided at concessional rates.

Thus, a financial analysis enables the project analyst to establish the financial sustainability of the project by identifying any financing shortfalls that are likely to occur during the investment and operating stages of the project, and by devising the necessary means for meeting these shortfalls. Simply put, one of the main objectives of a financial appraisal for a government project is to determine whether a project can continue "to pay its bills" throughout its entire life or not; and if not, how can the shortfalls be met.

Distributional Impacts

The second reason for conducting a financial appraisal of public sector projects is directly related to understanding the distributional impacts of the project. For example, the difference between the financial price an individual pays for a liter of water (extracted from the financial cash flow statement) and the gross economic benefit he derives from consuming the water (derived from the economic resource flow statement) reflects a net gain to the consumer. Similarly the difference between the financial price inclusive of tax that a project faces and the economic cost of an input required by the project measures the tax gain to the government. Gains and losses of this nature will be more difficult to establish on the basis of economic analysis only.[12]

Profitability

In certain instances, to determine the financial profitability of the project, the government approaches a project like a private sector investor. This is necessary if privatization of the project is being considered. To estimate the value that a private investor would be willing to pay for the project, it is essential to determine the profitability of a project. Ascertaining the financial profitability is also necessary when government policies are designed to encourage

[12] The distributional analysis is presented in detail in a later Part. The actual estimation of distributional impacts for sector specific projects is presented in each case study.

small investors and certain groups in society to undertake projects by providing them with grants or loans. The government's decision to provide grants or loans to the sponsors of these projects is still based on whether the entire project yields positive economic returns or not, and whether it is financially sustainable or not. However, the small investor is concerned primarily about the financial profitability of the project and will undertake it only if it is likely to make him better off. Consequently, the government should appraise the project financially from the point of view of a single investor to determine whether it is profitable. In case the project is not profitable from the point of view of a single investor while the project generates positive net economic benefits, the government has to provide subsidy or budgetary support to the investor.

Financial Cash Flows: Concepts, Principles and Conventions

What is a Financial Cash Flow Statement?

The financial cash flow statement of a project is a profile of the project's receipts and expenditures over time. The cash flow statement is organized in two main sections. The first section typically contains the expected financial receipts generated by the project, while the second one contains the expected financial expenditures incurred to generate the receipts of the project. The project's total expenditures, also known as total outflows, are subtracted from its receipts (inflows) to provide the net cash flow from the project. The Table 6.1 is an illustration of some of the line items that may appear in the financial cash flow statement of a project. At this early stage of the presentation, the table is only intended to give an idea of the type of variables that are included in a cash flow statement, and how they are organized in the statement. This Table will also be referred to later when discussing some of the variables that make up a cash flow statement.

Table 6.1: Organization of Variables in a Financial Cash Flow Statement

Financial Receipts:

1. Sales
2. Changes in Account Receivable
3. Residual Values
   (a) Land
   (b) Equipment
   (c) Buildings
4. Total Inflows

Financial Expenditures:

(i) INVESTMENT EXPENDITURES/OPPORTUNITY COSTS

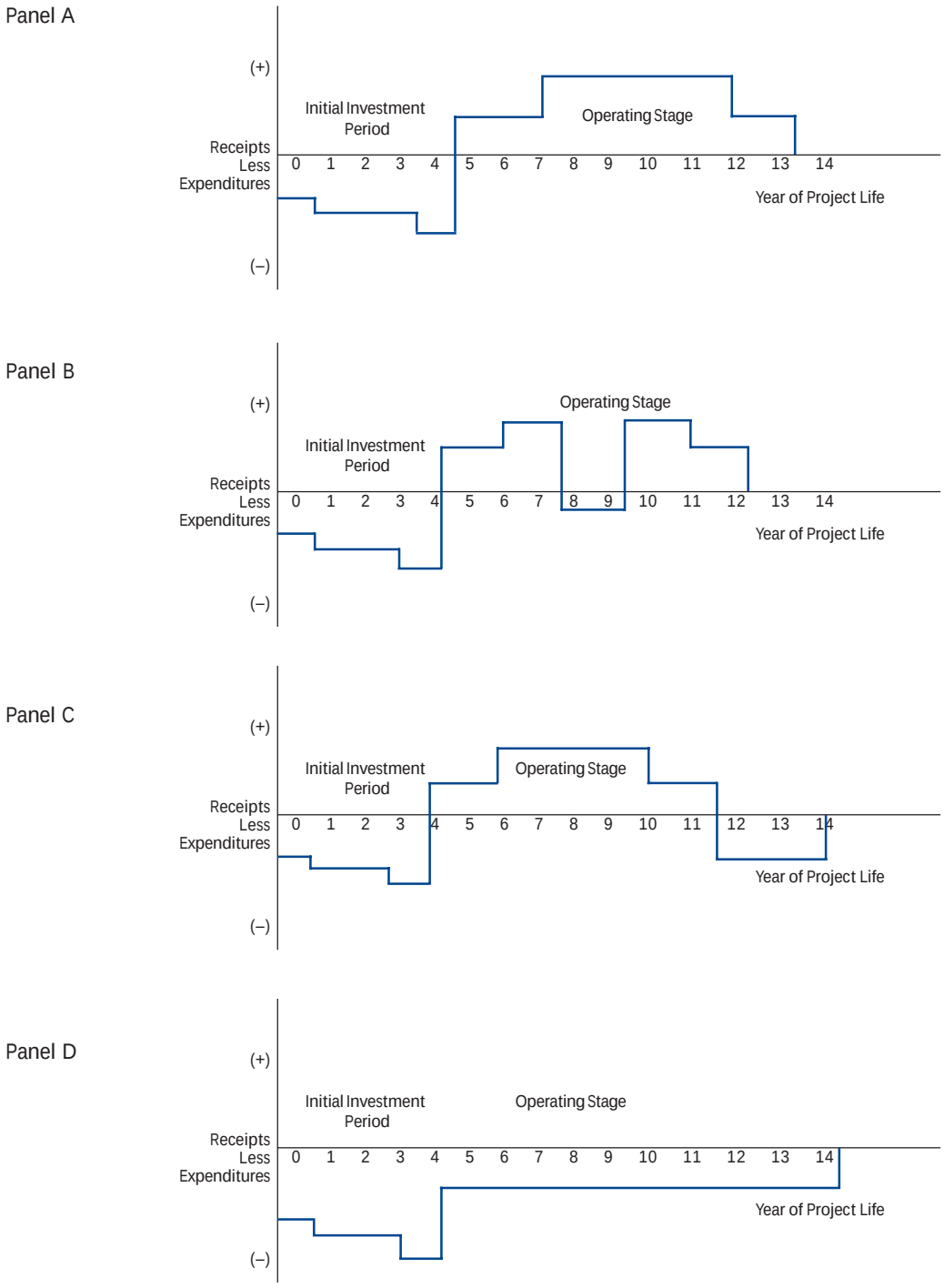
5. New Investment
   (a) Land
   (b) Type 1 Equipment
   (c) Type 2 Equipment
6. Buildings
7. Existing Assets (if any)
   (a) Land
   (b) Equipment
8. Buildings

(ii) OPERATING EXPENDITURES

9. Raw Material (1)
10. Raw Material (2)
11. Raw Material (n)
12. Management
13. Skilled Labor
14. Unskilled Labor
15. Maintenance
16. Changes in Account Payable
17. Changes in Cash Balance
18. Total Outflows
19. Net Cash Flow

The Figure 6.1 illustrates four of the different profiles that a net cash flow can have. Each profile is a plot of a project's receipts net of expenditures (net cash flows) against the sequence of years that make up the project's life.

Figure 6.1: Different Financial Project Profiles



Typically, a project's net cash flow is negative in the early part of a project's life (the investment stage) when the initial investment is being undertaken and the project is not generating any receipts. Once the investment is completed and the project starts operating, the net cash flow is likely to be positive. This is depicted in Panel A. While this is the profile commonly used to present a project's net cash flow, it is not the "standard" profile for most projects.

Panel B presents an alternative situation where a period of reinvestment or plant retooling is planned during the life of the project. This may result in negative net cash flows during the operating life of the project. Panel C presents a profile for a class of projects that require a large expenditure at the end of the project. The expenditure could be, for example, attributed to clean-up and landscaping costs associated with a mining project, or the decommissioning of a power plant. The profile of the net cash flow in Panel D represents projects that do not generate any financial receipts (road projects that charge no tolls), or projects that generate low receipts that are insufficient to cover operating expenditures (possibly water and wastewater projects). In such cases, the project will have a large initial outlay during the investment stage and will continue to show negative net cash flows during the operating stage.

If the project under consideration is an ongoing concern or a rehabilitation project where some of the project's old assets are integrated into the proposed facilities, the opportunity cost of these assets should be included in the cash flow statement together with the expenditure on new acquisitions.

Components of a Cash Flow Statement

The construction of the cash flow statement depicted in table above is generally preceded by the chronological organization of variables and data into three stages: an investment stage, an operating stage, and a cessation-of-operations stage. Each of these stages corresponds to a plan. Most of the data required for these three plans should be already organized in the technical, demand, manpower, and financing modules discussed earlier. Rules for including variables and data in the cash flow statement are presented and discussed for each of the three plans. There is however one simple guideline that can be mentioned here. "Only cash impacts are included in the cash flow statement, with one exception. This exception is the opportunity cost of existing assets."[13]

This guideline is applicable to the construction of the cash flow statement as a whole and can help the analyst when in doubt whether a variable should be included in the cash flow statement or not.

Investment Plan

The first step in the construction of a financial cash flow statement is the formulation of an investment plan for the project based on the information developed in the technical, demand, manpower, and financing modules. The investment plan consists of two sections: the first deals with the expenditure on new acquisitions, and the opportunity cost of existing assets, and the second section deals with the financing aspects of the proposed investment. If there are different scales and/or locations under consideration, corresponding investment plans for each scale and/or location should be formulated.

[13] The opportunity cost of existing assets is discussed below in the section dealing with existing assets under the investment plan.

The Table 6.2 provides an illustration for sections an investment plan for a water supply project. All data in the investment plan regarding the expenditures on new acquisitions, and the opportunity cost of existing assets, if applicable, are included in the cash flow statement. Financing data is included in some statements but not others depending on the point of view as explained below.[14]

Data and Data Breakdown

Once time schedules and deadlines are formulated, expenditures should be broken down by year of expected expenditure. Expenditures on internationally traded items should be separated from expenditures on items that are not traded internationally. This breakdown is important for analyzing foreign exchange implications and later for estimating the economic costs associated with these expenditures. Each expenditure item should be broken down into its components, whenever possible and appropriate. For example, the final cost of an installed plant should be broken down by what suppliers receive, import tariffs, value added taxes, and/or any other payment to the government, freight charges, handling charges, installation costs, etc. Investment credits or other forms of subsidies should be explicitly presented.

Civil works and building construction should be broken down into raw material, and the different types of labor. These breakdowns are necessary for conducting the economic analysis of the project and are also important for providing a clear understanding of its cost structure. Moreover identifying the recipients of the various payments enables the project analysts and economists to determine some of the beneficiaries of the project.

The first section of Table 6.2 presents the investment expenditures for the water supply project in the manner described above.

Opportunity Cost of Existing Assets

If the project under consideration is an ongoing concern or a rehabilitation project where some of the project's old assets are integrated into the proposed facilities, the opportunity cost of these assets should be included in the cash flow statement together with the expenditure on new acquisitions.

It is necessary to distinguish the "opportunity cost" of an asset from the "sunk cost" of an asset. The opportunity cost of using an asset in a specific project is the benefit foregone by not putting the asset to its best alternative use. To measure the opportunity cost of an asset, a monetary value has to be assigned to it that should be equal to what has been sacrificed by using it in the project rather than in its next best use. On the other hand, the value of an asset is treated as a sunk cost if the asset has no alternative use. The opportunity cost of such an asset is zero.

For the sake of illustration, take an asset that has been purchased by a firm and it can be used to make only one product and nothing else. Also, it

[14] The sales revenues and cash expenditures in a project will occur almost on a continuous basis. However, these inflows and outflows have to be lumped together for each time period that may be a year, a quarter or a month. In this Guidebook, as a matter of convention, all inflows and out flows are supposed to occur at the end of the corresponding time period. One could very well assume that they all occur at the beginning of the time period. The important thing is to adopt any one of these conventions and then be consistent.

Table 6.2: Investment Plan for a Hypothetical Water Supply Project

Investment Expenditures

	Year 1			Year 2			Year 3			Year 4		
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
a. Water Reservoirs/Pumping Stations												
Civil Works	5.3	2.3	7.6	13.0	5.6	18.6	8.8	3.8	12.6	1.2	0.5	1.7
Equipment and Materials	0.5	2.1	2.7	1.6	6.3	7.9	0.7	3.0	3.7	0.2	0.9	1.1
b. Transmission Mains												
Civil Works	1.8	4.2	6.0	2.3	5.4	7.7	1.6	3.8	5.4	0.3	0.7	1.0
Equipment and Materials	2.2	9.0	11.2	2.8	11.4	14.2	2.0	8.1	10.1	0.4	1.5	1.9
c. Secondary/Tertiary Networks												
Civil Works	11.2	3.7	14.9	26.0	8.7	34.7	29.8	9.9	39.7	7.4	2.5	9.9
Equipment and Materials	4.5	17.9	22.3	10.4	41.7	52.1	11.9	47.6	59.5	3.0	11.9	14.9
d. Service Connections												
Civil Works	8.3	1.5	9.7	19.3	3.4	22.7	22.0	3.9	25.9	5.5	1.0	6.5
Equipment and Materials	1.9	7.8	9.7	4.5	18.1	22.7	5.2	20.8	26.0	1.3	5.2	6.5
e. Office Buildings	3.7		3.7	3.7		3.7	0.0					
g. Consulting Services	1.1		1.1	0.5		0.5	0.3		0.3			
h. Land Cost	25.0		25.0									
i. In-house Eng. Services	16.3		16.3	16.3		16.3	12.2		12.2	4.1	0.0	4.1
j. Taxes and Duties	12.4		12.4	25.6		25.6	25.7		25.7	6.3	0.0	6.3
Total	**94.2**	**48.5**	**142.7**	**126.1**	**100.5**	**226.6**	**120.4**	**100.8**	**221.2**	**29.7**	**24.1**	**53.8**

Summary of Investments

	Year 1			Year 2			Year 3			Year 4		
Civil Works			38.3			83.6			83.7			19.1
Equipment and Materials			46.0			96.8			99.3			24.3
Office Buildings			3.7			3.7						
Consulting Services			1.1			0.5			0.3			
Land Cost			25.0									
In-house Eng. Services			16.3			16.3			12.2			4.1
Taxes and Duties			12.4			25.6			25.7			6.3
Total			**142.7**			**226.6**			**221.2**			**53.8**

Financing

	Year 1	Year 2	Year 3	Year 4
Foreign Loans	117.7	160	160	53.8
Domestic Equity	25	66.6	61.2	

cannot be leased to any other firm and its scrap value is negligible. In other words, the asset has no alternative value except in its current operations. Clearly its opportunity cost is zero. Sunk cost involves neither current nor future opportunity cost and therefore should have no influence in deciding what will be the most profitable thing to do. It should, however, be noted that while the sunk cost of an asset should not be counted as a cost to a new project in examining its feasibility, any outstanding liabilities due to that asset may become the liability of the new project if the ownership is the same.

Major items of the existing assets should be broken down, similar to the expenditure on new acquisition into traded and nontraded and into a reasonable number of components whenever possible. The opportunity cost of the existing assets is generally included in the first year (conventionally year 0) of the project's cash flow profile. This is because the assets could be sold at that time if the project is not feasible.

The financial opportunity cost of an existing asset is the highest financial price that it could be sold for. The financial price paid for the assets when they were first acquired is irrelevant and should never be used to reflect the opportunity cost of an asset. The highest financial price is typically the higher of the in-use value of the asset and its liquidation value. The in-use value of the asset is what it would sell for if it were to be used as an ongoing concern. The liquidation value is what the asset would sell for if broken into its different components and sold in parts. For example, when considering the opportunity cost of any production plant, one should consider the in-use value of the plant if it continues to be operated as is, and its financial value if dismantled and the different parts are sold separately.

The most accurate way to determine in-use and liquidation values is through reliable market assessors. When estimating in-use values using assessors, the assessor's fees should be subtracted from the quoted value to obtain the net in-use value. Also when assessors give a liquidation value for a project's assets, the assessors' fees as well as the expenditures incurred in dismantling the assets should be netted from the quoted price to obtain a net liquidation value.

In the absence of an assessor, a rough estimate of the plant's value can be obtained by using the rate of *economic* depreciation of the assets. The economic depreciation rate for an asset reflects the loss in the market value of the asset and is generally different from the depreciation rate used for tax purposes. Economic depreciation rates for plants and equipment may be obtained from the plant manufacturer; technical journals may contain information on depreciation patterns; also insurance companies that insure a plant's assets have some estimates for the plant's rate of economic depreciation.

Suppose the installed cost of a wastewater treatment plant was A_0 in 1995. Also suppose that the plant has an economic life T, and that the plant's annual rate of economic depreciation is d_e. If the price index has risen from I_{1995} to I_{2005}, the in-use value of the plant can be estimated as follows:

$$\text{In-use value (2005)} = A_0 \times (1 - 10 \times d_e) \times (I_{2005} / I_{1995})$$

In a case where the rate of economic depreciation is the same as the rate of straight

line depreciation,

In-use value (2005) = $A_0 \times (1 - 10/T) \times (I_{2005} / I_{1995})$

The term in the first set of parentheses represents the remaining proportion of the value of the plant in purchasing power of 1995, and the term in the second set of parentheses adjusts the in-use value of the asset from the 1995 price level to the 2005 price level.

Investment Financing

The second half of the investment plan deals with the means and schedules of financing the investment expenditures. This data should be largely prepared in the financing plan already discussed. The sources of finance used whether equity or grants, domestic short term and long term loans, foreign loans, suppliers' credit, concessionary loans and other forms of foreign aid should be identified and the disbursement schedules should be formulated. The second section of the investment plan illustrated in the table above presents an example of a financing plan.

Whether the data in the financing section of the investment plan is included in the cash flow statement or not depends on the point of view considered. When appraising the project from an owner's point of view, the loan disbursement is an inflow, and the repayment is an outflow as the owner is looking to the net receipts after paying any debtors or other shareholders. The analysis of the financial performance of the total invested capital, however, is not concerned with the financing but is looking to determine the financial viability of the project to all investors irrespective of the sources and terms of financing. Different points of view are discussed below.

Operating Plan

The operating plan is developed on the basis of the data formulated and organized in the technical, demand (market), and manpower modules. It includes all cash receipts generated from the operations of the business and all operating expenditures. Expenditures and corresponding receipts should be projected by year of operation. Similar to investment expenditures, data breakdowns are necessary in operating plan as well. Operating expenditures should be broken down into internationally traded and internationally nontraded items; and each expenditure item should be broken down into its components, whenever possible. For example, maintenance expenditures should be broken down into materials and labor. Expenditures on different types of labor (skilled, unskilled, etc.) should be identified and recorded separately. Any taxes or subsidies associated with the operating expenditures should also be identified and recorded separately whenever possible. These breakdowns are necessary for conducting the economic analysis of the project and for providing a better understanding of the cost structure of the operating expenditures. The Table presents an illustration of an operating plan for a hypothetical water supply project.

Direct data requirements for a cash flow statement are slightly different from, and may not be as readily available as data requirements for income statements and balance sheets.[15] For example, an income statement includes sales

[15] One of the main reasons for more readily available information for balance sheets and income statements is that these statements are often required by law for disclosure and tax purposes.

and purchases, while a cash flow statement includes receipts and expenditures. Sales and purchases include credit as well as cash transactions, while receipts and expenditures are cash only. Even though direct data requirements for cash flow statements may not exist, a cash flow statement can be constructed from the information in a set of balance sheets and income statements. A few important distinctions between variables included in a cash flow statement and variables in other financial statements are discussed below. The distinction generally stems from the fact that noncash impacts (with the exception of opportunity costs) are not included in the cash flow statement.

Adjustment of Sales

Needless to say, a project's viability is not only determined by the sales it generates but also by the timing of the cash receipts from the sales. A cash flow statement records sales transactions only when the cash from the transaction is received. Typically, projects forecast their sales as a single line item which comprises both credit and cash transactions. Only cash sales are included in a cash flow statement. Many government projects and firms provide their goods and services to their customers without receiving immediate cash payments. Reasons for this vary. In some cases, it could be government policy to provide such credits, which indeed serve as short-term credit, to assist certain project sponsors. In other cases, a credit sale could be involuntary where it takes the customers several months to pay for the services they consume, such as in the case of water and electricity.

A distinction must be made between sales and cash receipts. When a project makes a sale, the

Needless to say, a project's viability is not only determined by the sales it generates but also by the timing of the cash receipts from the sales. A cash flow statement records sales transactions only when the cash from the transaction is received. Typically, projects forecast their sales as a single line item which comprises both credit and cash transactions.

good or service may be delivered to the customer but no money transferred from the customer to the project. At this point the project's accountants will record that the project has an asset called Accounts Receivable (AR) equal to the amount of the sale, or the proportion of it that was not in cash. In other words, the buyer owes the project for the goods or services that he has purchased and not yet paid for. Until the buyer has paid for what he has received, the transaction will have no impact on the cash flow statement. When the buyer pays for the items that he previously bought from the project, the project's accountant records a decrease in accounts receivable by the amount that the buyer has paid and an increase in cash receipts. Only then are these cash receipts included in the cash flow statement as inflows.

The cash receipts for any period equals the sales during the period plus the accounts receivable at the beginning of the period less the accounts receivable at the end of the period. The maximum amount of cash a project can receive during a period of time would be equal to the new sales and the outstanding receivables, if any. However if a balance of accounts receivable that has not been collected remains at the end of the period, then this balance should be netted from the maximum.

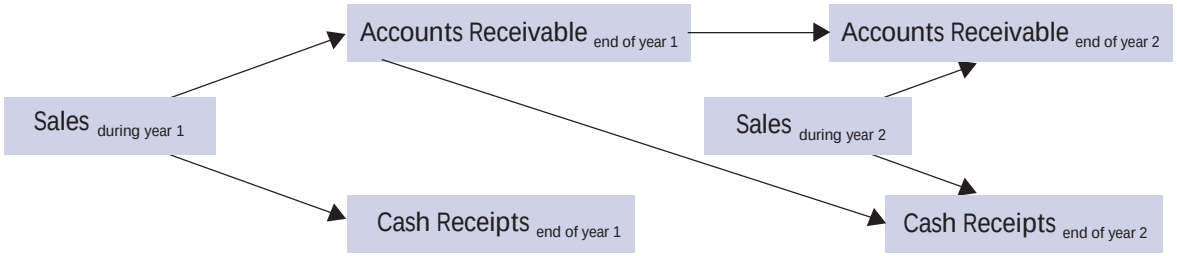
This is illustrated in Figure 6.2. The project makes 1000 Rupees worth of sales during the

first year, of which 600 Rupees are in cash and 400 Rupees are on credit. The cash inflow for this year should be 600 Rupees and not 1000 Rupees. Suppose the project's sales are 2000 Rupees during the second year, and at the end of the year, the outstanding receivables owed to the project are 500 rupees, then the cash receipts for this year would be 1900 Rupees. These are estimated as the beginning balance of accounts receivables (400 Rupees) plus the new sales during the year (2000 Rupees) less the final balance of accounts receivable (500 Rupees). If all the project's sales for the year were cash and all accounts receivable were collected, then cash receipts for the year would have been 2400 Rupees. However, given that a remaining balance of 500 Rupees in receivables, actual cash receipts are only 1900 Rupees.

Accounts receivable are typically measured as a percentage of sales. To determine the appropriate percentage of accounts receivable that a project will maintain, one can examine the current performance of the government department or corporation if the project is of a similar nature. If such information is not available, one should examine the industry standards or ranges.

Accounts receivable are typically measured as a percentage of sales. To determine the appropriate percentage of accounts receivable that a project will maintain, one can examine the current performance of the government department or corporation if the project is of a similar nature. If such information is not available, one should examine the industry standards or ranges. It is important to ensure that the accounts receivable selected for the project are consistent with the current performance of the department or industry standards. If not, plausible explanation should be given for why the proposed accounts receivable are different. For example, if a water supply project is proposing accounts receivable of two months while the current practice is four to five months, there must be a convincing reason why a change is proposed and how it will be actually affected.

Figure 6.2: Schematic Representation of the Relationship between Sales and Cash Receipts



Cash Receipts $_{\text{for the period}}$	=	Sales $_{\text{for the period}}$	+	AR $_{\text{beginning of period}}$	–	AR $_{\text{end of period}}$
Cash Receipts $_{\text{for year 1}}$	=	1000	+	0	–	400
	=	600 Rupees				
Cash Receipts $_{\text{for year 2}}$	=	2000	+	400	–	500
	=	1,900 Rupees				

Table 6.3: Operating Plan for a Hypothetical Water Supply Project: (A Few Years Only)

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Operations and Maintenance								
Personnel								
Connections/Employee	95	100	100	100	100	100	100	100
Total Employees	99	262	457	457	457	457	457	457
Unit Salary/mo. (Rupees)	4,245	4,330	4,416	4,505	4,595	4,687	4,780	4,876
Total Personnel Cost	5,058	13,629	24,219	24,703	25,198	25,702	26,216	26,740
Power/Fuel (Rupees/cum.)	8,961	13,011	16,672	16,672	16,672	16,672	16,672	16,672
Chemicals	16,842	16,842	16,842	16,842	16,842	16,842	16,842	16,842
Maintenance			8,439	8,439	8,439	8,439	8,439	8,439
Total	**30,861**	**43,482**	**66,172**	**66,656**	**67,150**	**67,654**	**68,168**	**68,692**
Production Schedule								
Connections								
Beginning		38,839	48,271	65,071	81,624	97,746	112,440	122,632
New		9,432	16,799	16,553	16,122	14,694	10,193	6,501
Ending	38,839	48,271	65,071	81,624	97,746	112,440	122,632	129,133
Cumulative New Connections		9,432	26,232	42,785	58,907	73,601	83,793	90,294
No. of Persons/Connection	8.4	8.0	7.5	7.5	7.5	7.5	7.5	7.5
Ave. Consumption/Person (liters/day)	150	160	200	220	220	220	220	220
Total Consumption (cum./day)	48,937	61,787	97,606	134,679	161,280	185,526	202,343	213,070
Incremental Consumption (cum./day)		12,850	48,669	85,742	112,343	136,589	153,406	164,133
Working Capital								
*Number of Months Accounts Receivable			3	3	3	3	3	3
Accounts Receivables		0	7.42	30.16	57.40	81.43	107.07	129.97
Change in Accounts Receivable			(7.42)	(22.74)	(27.25)	(24.03)	(25.64)	(22.90)
Cash Balance		0	4.07	8.64	14.63	19.09	23.86	28.82
Change in Cash Balance			(4.07)	(4.57)	(5.99)	(4.46)	(4.78)	(4.96)
Accounts Payable		0	8.85	14.39	23.12	27.89	32.89	38.29
Change in Accounts Payable			(8.85)	(5.54)	(8.72)	(4.77)	(5.00)	(5.40)

* A three month of accounts receivable implies that water bills are collected after three months of actual supply of water.

Also, when dealing with accounts receivable, it is important to assess the likelihood for bad debts and to make allowances for them. Bad debts occur when a project's customers default on their payments. Bad debts would lower the cash inflows to the project and need to be accounted for so that the cash flow statement is as realistic as possible. If accounts receivable at the end of the project operations are generally harder to collect, this should also be reflected in the cash flow statement.

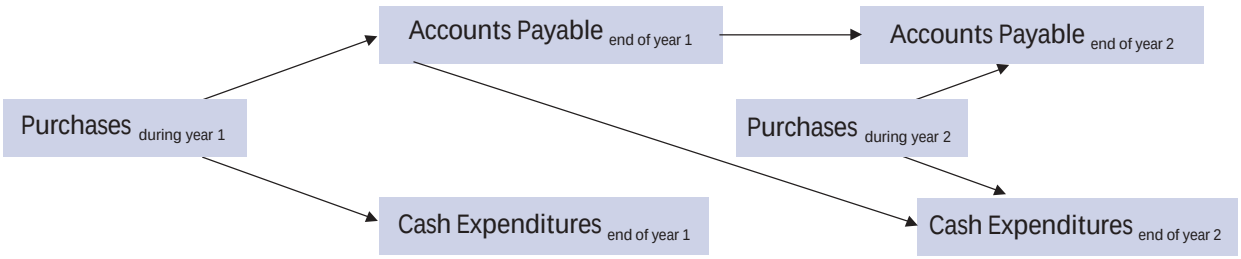
Adjustment of Purchases

Similar to the distinction between sales and receipts, a distinction is necessary between purchases and cash expenditures. The transaction is recorded in the cash flow statement only when the cash from the transaction is paid. When the project makes a purchase, the good or service may be delivered to the project but no money transferred from the project to its vendor. At this point the project's accountant records that the project has a liability called Accounts Payable (AP) equal to the amount of the purchase, or the proportion of it that was not in cash. In other words, the project owes the seller for the goods or services that it has purchased. Until the project has paid for what it has received, the transaction has no impact on the cash flow statement. When the project pays the vendors for the items it has bought from them, the project's accountant records a decrease in accounts payable by the amount that the project has paid and an increase in cash expenditures. These cash expenditures are included in the cash flow statement as outflows.

The cash expenditures for any period equals the purchases during the period plus the accounts payable at the beginning of the period less the accounts payable at the end of the period. The maximum cash expenditures that the project could make during a period equal the new purchases during the period plus the settlement of any outstanding accounts payable. However, if the project still maintains a balance of accounts payable at the end of that period, then the expenditures for the period is determined by subtracting the ending balance of the accounts payable from the maximum that the project could have paid. This is illustrated in the Figure.

Suppose, the project purchases inputs for 1000 Rupees during the first year of the project's operations. Sixty percent of these purchases are on a credit basis. Cash expenditures relating to purchases for the year are 400 Rupees and not

Figure 6.3: Expenditure Analysis



Cash Expenditures $_{\text{for the period}}$	=	Purchases $_{\text{for the period}}$	+	AP $_{\text{beginning of period}}$	–	AP $_{\text{end of period}}$
Cash Expenditures $_{\text{for year 1}}$	=	1000	+	0	-	600
	=	400				
Cash Expenditures $_{\text{for year 2}}$	=	2000	+	600	-	500
	=	2100				

1000 Rupees. Suppose that the project purchases additional inputs worth 2000 Rupees during the second year, and at the end of the year, the remaining accounts payable to be paid by the project are 500 Rupees, then the cash expenditures for this year would be 2100 Rupees. These are estimated as the beginning balance of accounts payable for the year (600 Rupees) plus the new purchases during the year (2000 Rupees) less the final balance of accounts payable (500 Rupees). If all the project's purchases during the year were paid for in cash and all outstanding accounts owed by the project were paid, then cash expenditures for the year would have been 2600 Rupees. However, given that there is a remaining balance of 500 Rupees in accounts payable, actual cash expenditures are only 2100 Rupees.

Accounts payable are typically measured as a percentage of total purchases or that of a major input. The appropriate amount of accounts payable that a project will maintain can be determined on the basis of the current performance of the government department if the project is of a similar nature. If such information is not available, one should examine the industry standards or ranges. It is important to ensure that the accounts payable on which the cash flows will be based are consistent with the industry norms.

Adjustment for Changes in Cash Balance

Increases and decreases in cash balances owned by the project can take place even when no change occurs in sales, accounts receivable, purchases or accounts payable. For example, when cash is set aside for the transactions of the business, it is a use of cash which is represented as an outflow in the cash flow statement. Similarly a decrease in cash held by the project is a source of cash for the project and its sponsors, and is a cash inflow. Note that any cash set aside will ultimately all be released back to the project as an inflow at the end of the project.

The amount of cash to be held for facilitating the transactions of the business is typically a percentage of the project's expenditures, sales, or major purchases and it can be determined by examining the performance of similar projects in the same sector or industry.

To illustrate how changes in the cash balance are incorporated in the cash flow statement, consider the following example. Suppose that a project has the sales profile given below and that the project's cash balance for any time period is 20 percent of the project's projected sales for that time period. Note that the initial amount of cash balance (20,000 Rupees) is treated as a cash outflow because this amount has to be set aside. Subsequent increases also

Table 6.4: Cash Flow Analysis

Year	1	2	3	4	5	6	7	8	9
Sales (in Rupees 000)	100	120	150	155	165	175	175	190	0
Cash Balance (in Rupees 000)	20	24	30	31	33	35	35	38	0
Changes in Cash Balance (in Rupees 000)	(20)	(4)	(6)	(1)	(2)	(2)	0	(3)	38

represent outflows. At the end of the project's operations when holding cash is no longer necessary, the entire amount of cash held (38,000 Rupees) is released back into the project and is treated as an inflow.

Working Capital

Working capital of a project is generally defined as the project's current assets net of its current liabilities. Current assets typically include cash and marketable securities, accounts receivable, inventories and prepaid expenses. Current liabilities include accounts payable, and any other form of debt that is due within a year or so. The analysis of working capital in this section has two objectives. The first objective is to determine how working capital is accounted for in the cash flow statement, and the second is to determine how working capital requirements for a project are estimated and financed.

Changes in prepaid expenses should not be included in the cash flow statement. An expenditure item is recorded as a cash outflow once an actual outlay takes place. Whether the expenditure was to pay for past rent or for future rent is irrelevant when constructing a cash flow statement.

Accounting for Working Capital in the Cash Flow Statement

The impacts of changes in accounts receivable and in accounts payable on the cash flow statement have been explained and demonstrated when discussing the distinction between sales and receipts, and purchases and expenditures respectively. Changes in cash balances are directly recorded in the cash flow statement as explained above. No other element of the working capital needs to be included in the cash flow statement.

Changes in prepaid expenses should not be included in the cash flow statement. An expenditure item is recorded as a cash outflow once an actual outlay takes place. Whether the expenditure was to pay for past rent or for future rent is irrelevant when constructing a cash flow statement.

Changes in inventories should not be included in the cash flow statement. When a project purchases a certain amount of raw material, inventories will increase. These inventories are financed through a cash outflow and/or an increase in accounts payable. If the inventories have been paid for in cash, then a cash outlay has been recorded in the cash flow statement. If they have been acquired on credit terms, then they will be recorded in the cash flow statement only when they are paid for. The situation is similar when dealing with changes in the inventories of the final product. For example, a decrease in final good inventories implies an increase in sales. This in turn implies an increase in cash receipts or accounts receivable.

Since the components of working capital are developed independently in different plans,[16] it is necessary to check for the overall consistency of working capital. This can be done by comparing the working capital implicitly estimated for the project to industry averages or to similar projects operated by the same department if available.

Estimation of Working Capital Requirements

Ensuring a project's access to sufficient working capital is crucial for the project's success. When a project starts its operations, it typically incurs

[16] For example, accounts receivable are identified as a percentage of sales in the demand or market plan; accounts payable are estimated as a percentage of purchases in the technical plan; sources of finance are identified in the project's financing plan, etc.

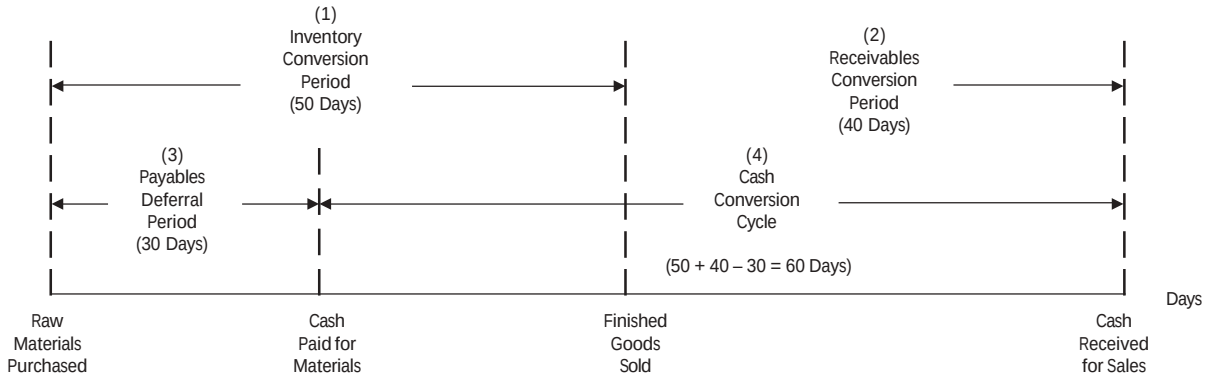
expenditures without generating receipts. During this period and till the project starts generating sufficient receipts, it is important to carefully estimate the working capital requirements for a project and determine how they will be met.

Initial working capital requirements for any project depend on the inventory conversion cycle, the receivables conversion cycle and the payables conversion cycle and ultimately on the cash conversion cycle. The inventory cycle is the time period for converting raw materials into final goods; the receivables cycle is the time period for converting accounts receivable into cash; the receivables cycle is the time period for converting accounts payable into cash. The cash cycle is the net outcome of the inventory, receivable and payable cycles.

The Figure 6.4 provides an illustration of how the working capital financing needs are determined. Suppose a project buys raw material on credit and pays after 30 days. Also suppose that it takes about 50 days to convert raw materials into final products and to sell them. Finally, suppose that it takes 40 days to collect the outstanding accounts receivable. In this case the cash conversion cycle is estimated to be the inventory conversion cycle plus the receivables conversion cycle less the payables conversion cycle, (i.e., 50 days plus 40 days less 30 days = 60 days). Consequently, the project analyst should determine the project's expenditures during the 60 days, and suitable means of financing should be sought.

The cash conversion cycle on which the working capital requirements are based is typically much shorter than the unit of time used in the cash flow statement which is generally one year. In other words, a net cash flow for the first year of operations will reflect the total receipts generated during the year net of total expenditures without shedding any light on whether there is enough working capital to get the project started and keep it in progress. It is quite probable that the net cash flow for the first year of operations is indeed positive but not enough working capital has been secured to ensure that the project continues to function smoothly. Consequently, it is necessary that

Figure 6.4: The Cash Conversion Cycle



Source: *Brigham, Eugene F.,* Fundamentals of Financial Management, Fifth Edition, *The Dryden Press, 1989.*

working capital requirements for a project are explicitly worked out, and the appropriate means of financing identified.

Estimation of Income Tax Liability

Income taxes, if expected to be paid by the project, should be included in the cash flow statement. The income tax liability is estimated on the basis of the project's income statement and follows the accounting and tax rules of the country/state. Year by year estimates of cost of goods sold, interest expense, depreciation expense, overheads (if not included in costs of goods sold) are subtracted from the project's revenues to estimate the project's earning before taxes. When estimating the income tax liability, provisions for loss carry forward should be taken into account.

Cessation of Project Operations

When a new project acquires an asset, the entire expenditure on the asset is accounted for in the cash flow statement at the time that the expenditure actually occurs. It is quite possible, however, that the life of the project does not coincide with the life of all its assets, or that the span of the analysis does not extend as far in the future as the project may be expected to operate; for example, railway projects or irrigation systems. If either of the two conditions exists, then the residual value of the asset, i.e., the value of the part of the asset that has not been used should be included in the cash flow statement as an inflow in the year following the cessation of operations.

Consider the following example to illustrate the point. Suppose a project acquires a piece of machinery for one million Rupees in 1998. The machinery has an economic life of 10 years and the expected life of the project is 7 years. The expected market value of the machine at the end of the seventh year is 150,000 Rupees. If we were only to include the expenditure on the machinery (one million Rupees) as an outflow without including the residual value (150,000 Rupees) as an inflow, then we would be penalizing the project.

As a matter of convention, residual values are recorded in the cash flow statement in the year following the cessation of operations. The underlying assumption is that liquidating assets may require a few months. When determining the residual value of the assets at the end of the project, it is preferable to break down all the assets into different categories: land, building, equipment, vehicles, etc. The residual value is taken as the higher of the in-use or liquidation value. The in-use value of the plant is the value of the plant under the assumption that it will continue to operate as an ongoing concern. The liquidation value is the value of the assets if all components of the project are sold separately and perhaps even the plant is taken apart and liquidated.

This approach is similar to that taken when estimating the opportunity cost of existing assets. It is, however, more difficult in this case to estimate the in-use and liquidation values since we are dealing with a situation in the future. General guidelines could be utilized to determine the residual values for these assets based on published *economic* depreciation rates that specify how much of the value of a certain type of the asset is lost as a function of time and/or use. The depreciation rates could be obtained from plant manufacturers; technical journals may contain information on depreciation patterns; also insurance companies (that insure a plant's assets) have some estimates for the plant's rate of economic depreciation.

Land

Land is a special asset in that it generally does not depreciate. The residual value of land recorded in the cash flow statement should be equal to the market value of the land recorded at the beginning of the project, adjusted for the expected inflation rate over the life of the project, unless the project results in some improvement or deterioration to the land. Situations where the project may enhance the value of land should be regarded with caution and should be treated as the exception rather than the rule. In many cases, expectations may indicate that land values are likely to rise faster than the general rate of inflation but the increase is totally unrelated to the project. It is important that project analysts do not include any increase beyond the general rate of inflation in the residual value of the land.

There are two ways in which the cost of land may be included in the cash flow of a project. The first one is straightforward: any appreciation (depreciation) that cannot be attributed to the project is simply ignored and the capital cost is included as investment cost at the beginning of the project and the same value is included as liquidation value at the end of the project life. Thus if land cost is 100,000 rupees, the investment cost and the residual value will be included as:

Table 6.5: Overall Investment Analysis

Year	0	1	2	3	4
Land	-100,000				100,000

In case of inflation, the final value in year 4 should take the inflation into account so that the real value, with respect to year 0, remains unchanged. Final year benefit should be different from Rupees 100,000 only if the land is physically improved or damaged as a result of the project.

An alternative approach is to levy an implicit rental charge as a cost in each time period even when no actual rental is paid. For instance, if a piece of land that is worth 100,000 rupees is used for a project and it could fetch a market rent of 8 percent per annum, 8000 rupees should be included as the annual cost in the cash flow as shown in the following:

Table 6.6: Annual Cost Analysis

Year	0	1	2	3	4
Land		-8,000	-8,400	-8,820	-9,261

This would correctly account for the opportunity cost of the piece of land. If there is an annual appreciation (depreciation) in rent, then the appreciated (depreciated) rental value is the annual cost but in this approach the value of land improvement or damage should be included in the final year of the cash flow. With a real appreciation rate of 5 percent per annum, the rental value would be included in the cash flow Table as follows:

Table 6.7: Cash Flow Analysis

Year	0	1	2	3	4
Land		-8,000	-8,000	-8,000	-8,000

The Financial Analysis from Different Points of View

For most projects that are directly undertaken by the government, or involve some government intervention in the form of grants, loans or subsidies, there are several stakeholders that would like to determine the impact of the project on them. Stakeholders are defined

broadly to include all those affected by the project. For example, the stakeholders of a project may include the owners, participating banks, any other government department providing loans or grants or collecting taxes, competitors, workers, etc. It is therefore necessary to conduct the analyses from the points of view of the different important stakeholders to ensure the project's sustainability and success. Even one powerful stakeholder who is adversely affected by the project may be able to derail the entire project.

For most projects that are directly undertaken by the government, or involve some government intervention in the form of grants, loans or subsidies, there are several stakeholders that would like to determine the impact of the project on them. Stakeholders are defined broadly to include all those affected by the project.

The preceding sections outline the variables that are generally included in the cash flow statement while discussing how they are presented. Some variables will be relevant to the analysis from the point of view of one stakeholder and not from that of another. The most commonly undertaken financial analyses for government and government-related projects are from the following viewpoints:

i) Point of view of owner;

ii) Point of view of all investors combined (banker's point of view or total investment point of view); and

iii) Point of view of the Budget.

These points of view are discussed below focusing on the differences in the variables included in the analyses from the different perspectives.

i) The Owner's Point of View

The owner or sponsor of a project could be a private investor (who may be receiving some form of support from the government or investing under some form of partnership arrangement with the government) or a government department or authority undertaking a project. The appraisal of the project from the owner's perspective includes all receipts and expenditures related to the project in the cash flow statement to determine whether he is made better off or not. Consequently, the owner or sponsor of the project receives the net cash flow after paying off all other involved parties, including the debt holders. The cash flow statement from an owner's point of view includes the disbursement of the loan as an inflow and all subsequent repayments of loan and interest as expenditures. If the project receives any grants or subsidies, these should be included as receipts in the cash flow statement; and if the project pays taxes, these should be included as a cash outflow. If the project sponsor is going to give up an existing source of income to undertake a project, the forgone earnings i.e. the opportunity cost should be included as an expenditure item in the cash flow statement.

ii) The Total Investment (Banker's) Point of View

This point of view examines the returns to the total invested capital. In other words, this analysis disregards any distinctions in the sources of finance. It asks whether the financial receipts generated from the operations of this project are sufficient to cover the investment and operations expenditures, and provide a sufficient return or not. This point of view is also known as the banker's point of view because a bank will be interested in examining the expected receipts and expenditures to

determine if the net cash flows from the total investment are sufficient to cover the loan and interest repayments. The banker typically has first claim to the project's assets and net cash flows, and so the banker's net cash flow is the project's gross receipts net of operating and investment expenditures.[17] The net cash-flows from the total investment (also called the "free cash flows") are, therefore, important in studying whether these cash flows adequately cover the expected debt repayment schedule. The size, pattern and stability of these cash flows will affect the patterns of debt repayment a project can sustain. For example, if large net cash flows are only expected late in the life of a project, then the debt repayment has to be structured to match that cash-flow pattern.

The only difference between the analysis from the owner's point of view and that from the banker's point of view is financing. Specifically, the cash flow statement from the total investment point of view includes all items included from the owner's perspective except loan and loan repayments.

iii) Budgetary Point of View

The purpose of the analysis from the budgetary point of view is to ensure that the relevant department has enough resources to finance its obligations to the project during both the investment and operational phases. If the government department is the project owner, then the only distinction between the cash flow statement from the owner's point of view and from the budget point of view is that opportunity costs are not taken into account in the latter statement. If, on the other hand, the government's involvement is in the form of providing some cheap credit, subsidies, or grants, then the cash flow statement only reflects these transactions.

Other Perspectives

Although the three views outlined above are the most typical points of view considered when conducting the financial analysis, it is important to analyze the impacts of the project on all involved parties. For example, if the project under consideration is likely to have a negative impact on competitors, one should anticipate their resistance and seek feasible solutions. It is thus necessary to estimate the magnitude of the damage to any affected group. Affected groups could include, competitors, suppliers of inputs, downstream processors, etc.

Can this Analysis be Applied to Social Sector Projects?

There are two aspects to this issue. First, is financial analysis relevant for a social sector project? One might argue that it is only the economic analysis that is relevant and if a social sector project is economically sound, its financial analysis is of little consequence. This view is, unfortunately, erroneous. The financial cash flows are crucial for projecting the cash position of the project in the future and determining if and when cash injections from external sources, including the government budget, would be necessary. This may make all

[17] In few cases, a subtle difference may exist between the point of view of total invested capital and the banker's point of view. Consider, for example, a government department that is encouraging the construction of low-income housing projects by repaying the interest on the housing loan. An analysis from the total invested capital point of view will not be concerned with the loan at all whether subsidized or not. A banker however, will be definitely more in favor of loaning to a project that receives a government loan subsidy than a similar project that does not receive the subsidy.

the difference between a successful project and a failed project. If the project cannot be implemented due to paucity of funds and lack of advance planning, there is not going to be any economic benefits from the project. Also, it is essential to have an accurate and detailed financial analysis along with an economic analysis in order to conduct the distributional analysis of the project.

Another aspect of this issue is whether it is possible to prepare a detailed financial cash flow, as outlined in the preceding sections, in case of a social sector project. The answer is clearly yes. There is hardly any difference between a social sector project and an industrial project in preparing the cash flow on the cost side. On the benefit side, one has to include whatever revenues are being generated by the project along with other elements like grant/ subsidy and liquidation values. In the extreme case when the services are being provided free of cost, the revenues are zero and the financial analysis is able to indicate the yearly requirement of funds for continuing with the project. In case, it is not necessary or possible to quantify financial benefits in monetary terms or when choosing among different technologies for providing the same services, one has to apply the "cost effectiveness" criterion. For doing so, the present values of alternative sets of costs have to be estimated. This is only possible when an elaborate and accurate cash flow has been prepared. It is, therefore, evident that the financial analysis as outlined above is both essential and feasible in case of a social project as well.

Finally, it is important to realize that an analysis that includes the costs and benefits to all involved parties constitutes the first step in the economic analysis of the project. Indeed, this is the starting point for the discussions on the economic analysis presented earlier. A summary of how different financial items should be included in the cash flow statement from different points of view is given in Table 6.8.

The Use of Consistent Prices in Financial Appraisal: Inflation Treatment

When conducting a financial appraisal of a project, it is necessary to develop price and cost projections over the life of the project. These prices are influenced by the forces of demand and supply, which affect relative prices, and by macroeconomic conditions, which determine the general price level or the level of inflation. Accurate forecasts of the future growth in relative prices and in the general price level are beyond the responsibility of the project analyst. However historical trends in growth of prices coupled with recent and expected government policies provide a good basis for making these projections. Variations in these assumptions should be tested using sensitivity and risk analyses to determine whether the project is robust enough to withstand deviations from the assumptions in the base case.

To understand the impact of inflation on the financial viability of a project and how it is incorporated in the analysis, it is necessary to understand the distinction between the different prices and price levels. These are presented in sufficient detail in Annex at the end of this Part. Two prices however are discussed below due to the important role they can play in the financial analysis of projects. These are the interest rate and the price of foreign exchange.

Interest Rate

The most important feature for integrating

expectations about the future rate of inflation or expected growth in prices gP^e into the project evaluation is to ensure that such expectations are consistent with the projections of the nominal rate of interest (i). Lenders increase the nominal interest rate on the loans they give to compensate for the anticipated loss in the real value of the loan caused by inflation. As the inflation rate increases, the nominal interest rate increases to ensure that the present value of the interest and principal payments does not fall below the initial value of the loan.

The nominal interest rate i as determined by the financial markets is made up of three major components: (i) the real interest rate r which reflects the real time value of money that lenders require in order to be willing to forego consumption or other investment opportunities; (ii) a risk factor R which measures the compensation lenders demand to cover the possibility of the borrower defaulting on the loan; and (iii) a factor $(1+r+R)gP^e$ which represents the compensation for the expected loss in purchasing power attributable to inflation. Inflation reduces the future value of

A key financial variable in any project using or producing tradable goods is the market rate of exchange (EM) between the Rupee and the foreign currency. This market exchange rate is expressed as the number of units of Rupees required to purchase one unit of foreign exchange (F). The market exchange rate is the current (nominal) price of foreign exchange. The market exchange rate needs to be projected over the life of the project.

Table 6.8: Summary of Cash Flows Statement from Different Points of Views

	Point of View of Owners	Point of View of all Investors (Banker's or Total Investment Point of View)	Point of View of Budget	Point of View of Economy
	(A)	(B)	(C)	(D)
	Include all Receipts in Inflows and all Expenditure Related to the Project in Outflows	= (A) – Loan and Loan and Interest Repayments	Include all Subsidies/Grants to the Project in Outflows and Taxes from the Project in Inflows	= A – all Transfers + Externalities
Grant/Subsidy	+	+	-	Not Included
Loan	+	Not Included	Not Included	Not Included
Investment Costs	-	-	Not Included	-
Operating Costs	-	-	Not Included	-
Loan Repayment	-	Not Included	Not Included	Not Included
Interest Payment	-	Not Included	Not Included	Not Included
Foregone Earnings	-	-	Not Included	-
Taxes	-	-	+	Not Included
Positive Externalities	Not Included	Not Included	Not Included	+
Negative Externalities	Not Included	Not Included	Not Included	-

both the loan repayments and real interest rate payments. The expected rate of inflation for each period of the loan is expressed as gP^e. Combining these factors, the nominal (market) rate of interest i can be expressed as:

$$i = r + R + (1 + r + R)\, gP^e$$

To explain this concept more fully, let us consider the following financial scenarios. When both risk and inflation are zero, a lender would want to recover at least the real time value of money. If the real interest rate r is 5 percent, then the lender would charge at least a 5 percent nominal interest rate. If the lender anticipates that the future rate of inflation gP^e will be 10 percent, then she would want to increase the nominal interest rate charged to the borrower in order to compensate for the loss in purchasing power of the future loan and interest rate payments. Maintaining the assumption that there is no risk to this loan, we can apply the above equation to determine what nominal interest rate she would need to charge to remain as well off as when the inflation rate was zero.

Experience with projects suffering from financial liquidity and solvency problems has demonstrated that inflation can be a critical factor in the success or failure of projects. Correctly designing a project to accommodate both changes in relative prices and changes in the rate of inflation may be crucial for its ultimate survival.

$$\begin{aligned} i &= r + R + (1 + r + R)\, gP^e \\ &= (0.05) + (0) + (1 + 0.05 + 0)0.1 \\ &= 0.155 \text{ or } 15.55\% \end{aligned}$$

Thus, the lender will need to charge a nominal interest rate of at least 15.55 percent to achieve the same level of return as in the scenario with zero inflation.

Generally, the real rate of interest is a fairly constant value because it is primarily determined by the productivity of investment and the desire to consume and save in the economy. Also, the value of the risk premium for the various sectors and investors is typically known. Given the real interest rate, the risk premium and the nominal interest rate, the expected rate of inflation, which is implicit in the nominal interest rate can be estimated by rearranging the above equation as follows:

$$gP^e = (i - r - R)/(1 + r + R)$$

If the rate of inflation is expected to change through time and refinancing of the project's debt is required, then the nominal interest rate paid must be adjusted to be consistent with this new expected rate of inflation. This should have little or no direct effect on the overall economic viability of the project as measured by its NPV; however, it may impose very severe constraints on the liquidity position of the project because of its impact on interest and principal payments if not properly planned for.

Expected (Nominal) Exchange Rate

A key financial variable in any project using or producing tradable goods is the market rate of exchange (E^M) between the Rupee and the foreign currency. This market exchange rate is expressed as the number of units of Rupees required to purchase one unit of foreign exchange (F). The market exchange rate is the current (nominal) price of foreign exchange. The market exchange rate needs to be projected over the life of the project. The market rate

between the Rupee and the foreign currency can be expressed at any point in time (t) as:

E^M_t= (#Rupees/F)$_t$

The difference between the real price and the nominal price of a good at a given point in time, t_n, lies in the cumulative inflation measured from an *arbitrary* fixed point in time, t_b (base year), to the current point in time, t_n. If we choose the arbitrary point in time to be the same as the current point in time, then there is no difference between the real and nominal prices. For convenience when conducting the financial appraisal of a project, we can select the first year of the project, t_0, as the arbitrary reference point or base year. Consequently, the market exchange rate and the real exchange rate will be equal for that year, t_0.

The cumulative inflation for India over a period of time is given by the domestic price index I^D. If we continue to use the reference year, t_0, as the base year, the domestic price index at any point in time t_n, can be expressed as the cumulative change in the price level from time t_0, to t_n This is given as follows:

$$I^D_{t_n} = \prod_{i=1}^{i=n} g_i^{pde} (1 + g^{pde}_{t_0+i})$$

where, g_i^{pde} is the rate of inflation in the domestic economy.

Similarly, the foreign price index at any point in time t_n, using the same reference year, t_0 as the base year, can be expressed as the cumulative change in the price level from time t_0, to t_n This is given as follows:

$$I^F_{t_n} = \prod_{i=1}^{i=n} (1 + g^{pfe}_{t_0+i})$$

where, g_i^{pfe} is the rate of inflation in the foreign economy. Thus the market exchange rate at time t_n may be expressed in terms of the real exchange rate and price indices as follows:

$$\text{Real Exchange Rate } E^R = \frac{Rupees / I^D_{T_n}}{F / I^F_{t_n}} = \frac{Rupees}{F} \frac{I^F_{t_n}}{I^D_T}$$

$$\text{Or } E^R = E^M_{t_n} \frac{I^F_{t_n}}{I^D_{t_n}}$$

From this we conclude

$$E^M_{t_n} = E^R * \left(I^D_{t_n} / I^F_{t_n} \right)$$

or

$$E^M_{t_n} = E^R * \left(\frac{\prod_{i=1}^{i=n} (1 + g^{pde}_{t_0+i})}{\prod_{i=1}^{i=n} (1 + g^{pfe}_{t_0+i})} \right)$$

The real exchange rate moves through time by the forces of the country's demand and supply for foreign exchange. From the point of view of the project analyst, it is very difficult to predict the movement of the real exchange rate unless it is being artificially maintained at a given level through tariffs or quantitative restrictions on either the supply or demand of foreign exchange. If the rate is not artificially maintained, the analyst can take the real exchange rate as constant throughout the life of the project

The ratio of the two price indices is known as the relative price index. If through time the domestic economy faces a rate of inflation different from that of a foreign trading partner, the relative price index will move over time. If the real exchange rate, E^R, is to remain constant

in the presence of inflation, then the change in the relative price index must result in an equal change in the market exchange rate.

Since the future real exchange rate is only likely to be known with some uncertainty, and the market exchange rate might not adjust instantaneously to changes in the rate of inflation, it is more realistic to allow some flexibility in the estimation of the market exchange rate. This is carried out by assuming a range for the distribution of possible exchange rates around an expected mean real exchange rate. To incorporate this aspect we write the above equation as follows:

$$E^{M}_{t_n} = E^{R} * (1+k)\left(\frac{\prod_{i=1}^{i=n}(1+g^{pde}_{t_0+i})}{\prod_{i=1}^{i=n}(1+g^{pfe}_{t_0+i})}\right)$$

where, K is a random variable with a mean of 0.

Incorporating Inflation in the Financial Analysis

Much of the published literature on project evaluation recommends the exclusion of inflation from the appraisal process.[18] At best, these methods only account for projected changes in relative prices of inputs and outputs over the life of the investment.[19] However, experience with projects suffering from financial liquidity and solvency problems has demonstrated that inflation can be a critical factor in the success or failure of projects. Correctly designing a project to accommodate both changes in relative prices and changes in the rate of inflation may be crucial for its ultimate survival.

Improper accounting for the impacts of inflation when conducting the financial analysis could have detrimental effects not only on the financial sustainability of a project but also on its economic viability. Assumptions regarding inflation will have a direct impact on the financial analysis of the project and may require adjustments in the operating or investment policies. Since an inadequate treatment of inflation may adversely affect the financial sustainability of the project, ultimately the economic viability of the project may be compromised if inflation is not accounted for properly and the necessary adjustments are not made. The impacts of inflation on the financial analysis of a project are discussed in the annexure.

It is important to realize that the ultimate analysis of the financial cash flows should always be carried out on a statement prepared in real (i.e., net of inflation) Rupees. It is not easy to analyze nominal (current) prices or nominal net cash flows as one will be attempting to understand figures that reflect two changes: changes in the real price and changes in the general price level. The correct treatment of inflation requires that preparatory tables be made using nominal prices, and at the very end cash flow statements prepared in nominal

[18] L. Squire and H.G. van der Tak, Economic Analysis of Projects, (Baltimore: The Johns Hopkins University Press, 1975), p. 38.

[19] All of the following authors recommend that expectations of inflation of the general price level be ignored in the evaluation of projects: I.M.D. Little, and J.A. Mirrllees, Project Appraisal and Planning for Development Countries (New York –basic books, 1974) P. Dasgupta, A. Sen, and S. Marglin, Guidelines for Project Evaluation, (Vienna: UNIDO, 1972). Arnold C. Harberger, Project Evaluation Collected Papers, (Chicago: Markham, 1973), p. 44. A more satisfactory treatment of this issue is provided by M. Roemer and Joseph J. Stern, The Appraisal of Development Projects, A Practical Guide to Project Analysis with Case Studies and Solutions, (New York: Praeger Publishers, 1975), pp. 73-74. The authors present a rather mixed treatment of this issue in their case 3 which is not entirely consistent; see also pp. 173-174.

prices are deflated to obtain the cash flow statements in real prices.

Outlined below is a method for incorporating inflation into the financial evaluation of a project in a consistent manner. It draws mainly upon the methodology in the Guidebook on Cost-Benefit Analysis by Jenkins and Harberger.

When preparing the cash flow statement, certain variables such as tax liabilities, cash requirements, interest, and debt repayments need to be estimated in the current prices of the years they are to be incurred in. Other variables making up the cash flow statement are also presented in current prices and initially cash flows in current prices are developed. These cash flows are later deflated and presented in real prices. By constructing the financial analysis in this manner, we ensure that first, all the effects of inflation are consistently reflected in the projected variables and second, all variables are deflated by the projected increase in the general level of prices.

The steps required to carry out the analysis are as follows:

1. Estimate the future changes in the relative prices for each input and output variable. This involves the examination of the present and future demand and supply forces that are expected to prevail in the market for the item. For example, an examination of real prices of many minerals will indicate that they have been dropping a few percentage points a year over the past decade. Real wages, on the other hand tend to increase over time as the economy grows.
2. Estimate or develop a set of assumptions concerning the expected annual changes in inflation over the life of the project.
3. Determine what the nominal rate of interest will likely be over the lifetime of the project given the expected changes in the price level estimated above.
4. Combine the expected change in relative prices with the expected change in the rate of inflation to give the expected change in the nominal price of an item.
5. Multiply the nominal prices for each item by the projections of quantities of inputs and outputs through time to express these variables in the current year's prices of the period in which they are expected to occur.
6. Begin the construction of a cash flow statement using the current (nominal) values for the inputs and outputs.
7. Construct a profit and loss statement for each year of the project's life to determine income tax liabilities with all variables expressed in their nominal values. Depreciation expenses, cost of goods sold, and interest expenses and income tax liabilities are estimated according to the taxation laws of the country. The estimated income tax liabilities are included in the cash flow statement.
8. Estimate cash requirements and any changes in the stock of cash that are reflected in the cash flow statement.
9. Determine financing requirements along with the interest payments and principal repayments and include these items in the cash flow statement. This completes the construction of the projected variables in terms of their current values inclusive of inflation. Now we have a cash flow statement in current prices from the owner's point of view.

10. Deflate all items in the owner's cash flow statement by the inflation price index to arrive at real values for the cash flow statement. Note that loans, interest payments, and loan payments are included at their deflated values in the determination of the cash flow in real prices.
11. Discount the net financial cash flow to the owners of the enterprise by either the real (net of inflation) private opportunity cost of equity financing if it is a private owner or by the target financial rate of return (net of inflation) set by the government if it is a public sector enterprise.
12. Estimate the net financial cash flow from the point of view of the total invested capital. In this case, loans, interest and principal payments do not enter into the calculation of the net financial cash flow.
13. Calculate the net financial cash flow from other points of view if necessary (budget, etc.)

The case studies developed in this Guidebook provide illustrations of the inflation treatment outlined above. The development of proforma financial cash flow statements in this way ensures that the impact of inflation on the financial performance of the project is correctly accounted for. At the same time, the final financial analysis is completed with the variables expressed in terms of a constant general price level. In this way, the movement of such variables as receipts, labor costs and material costs can be compared over time without being distorted by changes in the general price level.

When the financial analysis is carried out in terms of real prices, it is essential that the private opportunity costs of capital or the target financial rates of return used as discount rates be expressed net of any compensation for the expected rate of inflation. In other words, these discount rates must be real and not nominal variables. If a nominal interest rate or target rate of return is used, the result will be a double correction for the expected changes in the general price level. Such practices will greatly distort the conclusions of the analysis concerning the financial viability of the project.

It should be noted that the real financial prices for the input and output variables developed above are used as the basis on which to estimate the economic values for the benefits and costs of the project. Once these economic costs and benefits are estimated, an economic resource flow statement is constructed. The structure of the statement should be similar to that of the financial cash flow statement. Finally, the difference between the two statements is analyzed to determine the distributional impacts of the project.

Part 7: Financial Cost of Capital

In this Section, we discuss the meaning, interpretation and use of the financial cost of capital in the context of valuing cash flow profiles in project appraisal. Since the financial cost of capital has a major impact on the overall assessment of the investment project from the financial point of view, it is important to have a clear understanding of the concept. Even though the assessment of the project from the economic point of view is the correct criterion for project selection, the financial assessment could determine the long term financial viability and sustainability of the project. In addition, the calculation of the financial cost of capital is complicated by the existence of taxes and debt financing.

Later, we explain how to adjust the financial cost of capital in the presence of taxes and debt financing. Moreover, as discussed below, there are two different points of view in the financial analysis, and for each point of view, there is a corresponding cost of capital.

As mentioned earlier in the previous sections, cash flows that occur at different points in time cannot be aggregated together. A financial cash flow of INR 1,000 that occurs in one year from now has less value than a cash flow of INR 1,000 that we can receive immediately right now. Through the process of discounting, with the appropriate discount rate(s), we "discount" all the future values to the present time, and sum them up to obtain the present value.

The concept of discounting also applies to economic cash flows. To be consistent, we have to discount the (nominal) financial cash flows with the appropriate (nominal) financial discount rate, and the corresponding economic cash flows with the appropriate economic discount rate, or more formally, the economic opportunity cost of capital (EOCK).

Nominal Cash Flow Statement

To take account of the direct and indirect impacts of inflation through various line items in the cash flow statement, we construct the cash flow statement in nominal terms. As shown in the Annexure, it is incorrect to construct the cash flow statement in real terms. For example, we pay taxes on annual net incomes that are based on current values and not real values. Thus, when we construct the cash flow statement in nominal terms it means that we have to explicitly model the profile of the expected inflation rate over the life of the project, and the real changes (if any) in the various line items in the cash flow statement relative to the expected inflation rate.

However, with nominal cash flow profiles, it is difficult to assess what is actually happening to the cash flows over time (relative to the expected inflation rate) **without** reference to the expected inflation profile. To have a properly understanding of the movement of the cash flow over time in real terms, we have to analyze the real cash flow, which we can obtain from the nominal cash flow by deflating the nominal cash flow with the expected inflation index.

If there are cash flow items in a foreign currency, then we have to model explicitly the expected nominal foreign exchange rate, which means that we have to model the expected inflation rate in the foreign country, in addition to the expected domestic inflation rate. First, we forecast the cash flow item in nominal terms in the foreign currency, taking into account the expected inflation rate in the foreign currency. Then we convert the foreign currency cash flow

into domestic currency by using the expected nominal foreign exchange rate. In the base case, we assume that the nominal foreign exchange rate follows Purchasing Power Parity (PPP), which means that the nominal foreign exchange rate fully accounts for the expected inflation rates in the domestic and foreign currencies. In the sensitivity and scenario analyses, we can examine the impact of deviations from PPP on the cash flow profile and the desired outcomes of the project.

In terms of valuation, we have to ensure that we properly distinguish the nominal cash flows and the real cash flows. And most importantly, we have to discount the nominal cash flows with the nominal cost of capital, and the corresponding real cash flows with the corresponding real cost of capital. Mixing nominal cash flows with real discount rates or real cash flows with nominal discount rates will lead to incorrect valuations.

TIP cash flow does not include any impact of debt financing, and thus, it should not include the tax savings that result from the deduction of interest payments in the income statement. In this case, in the construction of the income statement and the estimation of the tax liabilities, we should not include the interest payments as deductions from the earnings.

Points of View in the Financial Analysis

In the previous Section on the construction of financial cash flow statements from different points of view, we introduced two points of view: the equity holder's point of view and the total investment point of view (TIP). The equity holder's point of view is also known as the owner's point of view.

Briefly, the TIP cash flow represents the cash flow that the project generates **without** taking into account the financing of the project. It represents the free cash flow out of which the combined financiers (debt and equity holders) have to be paid. The TIP cash flow is also known as the cash flow from the Banker's point of view. In other words, it is the cash flow that the Banker, as the financier of the investment project, analyzes to assess the financial viability of the project. As part of the risk assessment, the banker (or debt holder) checks the TIP cash flow to see how well the debt service payments will be covered.

If we combine the TIP cash flow and the cash flow from the debt financing, we obtain the cash flow statement from the equity holder's point of view (or the owner's point of view). The cash flow to the equity holder is the most fundamental cash flow in project appraisal. The equity holder is the owner and the bearer of the residual in the project, and is the ultimate decision maker with respect to the design and attractiveness of a project.

Nominal Weighted Average Cost of Capital (WACC)

In cash flow valuation, we discount the nominal equity cash flow with the expected required nominal return to equity and we discount the nominal TIP cash flow with the appropriate nominal Weighted Average Cost of Capital (WACC). Since the TIP cash flow is the total cash flow that is available for distribution to the debt and equity holders, the nominal WACC, which is the appropriate financial discount rate for the TIP cash flow, reflects the two sources of financing.

Roughly speaking, the WACC is a weighted average of the sources of financing. If there is

one debt holder, and one equity holder, then the WACC is a weighted average of the nominal cost of debt and the nominal cost of equity, where the weights are the values of debt and equity, as percentages of the total value.

With the TIP cash flow, we have to be a little careful about the calculation of the taxes. Strictly speaking, the TIP cash flow does not include any impact of debt financing, and thus, it should not include the tax savings that result from the deduction of interest payments in the income statement. In this case, in the construction of the income statement and the estimation of the tax liabilities, we should not include the interest payments as deductions from the earnings. In this case, as explained below, we have to "lower" the Weighted Average Cost of Capital (WACC).

Alternatively, if we do include the tax savings in the derivation of the TIP cash flow, then there is no need to "lower" the WACC. In this case, in the construction of the income statement and estimation of the tax liabilities, we include the interest payments as deductions from the earnings. The tax liabilities is lower than in the previous case.

Here, in the expressions for the nominal WACCs in equations 1 and 2, we have used the nominal cost of debt and the nominal required return to equity.
If we use the real cost of debt and the real required return to equity, we can obtain the corresponding real WACCs for the TIP cash flow.

Box 7.1

Case 1: TIP Cash Flow Exclusive of Tax Savings

If we do not include the tax savings in the derivation of the TIP cash flow, then the expression for the nominal WACC applied to the TIP cash flow is as follows:

$$WACC = [D/(D + E)]\times r_D\times(1 - t) + [E/(D + E)]\times r_E \qquad (1)$$

Where r_D is the expected nominal return on the debt,
D is the market value of the debt,
t is the tax rate,
r_E is the expected nominal required return on equity and
E is the market value of equity.

Since we have not included the tax savings in the cash flow, we have to account for the tax savings by lowering the WACC by applying the term (1 – t) to the cost of debt r_D.

Case 2: TIP Cash Flow inclusive of Tax Savings

Alternatively, if we include the tax savings directly in the TIP cash flow, then the expression for the nominal WACC applied to the TIP cash flow is as follows:

$$WACC = [D/(D + E)]\times r_D + [E/(D + E)]\times r_E \qquad (2)$$

Where r_D is the expected nominal return on the debt,
D is the market value of the debt,
r_E is the expected nominal required return on equity and
E is the market value of equity.

In the second case, there is no need to "lower" the WACC with the term (1 – t) because we have included the tax savings in the TIP cash flow.

Consistency Check for the Two Financial Points of View

There is a simple consistency check on the valuation of the equity and TIP cash flows. The total value of a project equals the sum of the value of the debt and the equity.

$$\text{Total value} = \text{Value of debt} + \text{Value of Equity} \qquad (3)$$

In terms of NPV, the NPV of the TIP cash flow (inclusive of the tax savings), discounted at the

WACC equals the sum of the NPV of the cash flow to the debt holder, discounted at the cost of debt d and the NPV of the cash flow to the equity holder, discounted at the required return to equity e.

$$NPV^{TIP}_{WACC} = NPV^{CFD}_{d} + NPV^{CFE}_{e} \quad (4)$$

It is reasonable to assume that the NPV of the nominal cash flow to the debt holder, discounted at the nominal cost of debt, is zero, where the nominal cost of debt fully accounts for the expected inflation over the life of the project. This means that the debt holder obtains the expected real return on the debt, and does not gain or lose from financing the project.

$$NPV^{CFD}_{d} = 0 \quad (5)$$

With this assumption, it is easy to see that the NPV of the TIP cash flow, discounted by the WACC must equal the NPV of the cash flow to equity, discounted by the required nominal return to equity.

$$NPV^{TIP}_{WACC} = NPV^{CFE}_{e} \quad (6)$$

Numerical Example

We illustrate these ideas with a simple numerical example. For convenience, we have specified easy numbers for the calculations. Consider a project that requires an investment of INR 1,000 for the purchase of machinery at the end of year 0. The economic life of the machinery is five years, and the economic depreciation of the machinery equals the depreciation allowance for accounting purposes.

The project generates annual revenues of INR 450. The expected inflation rate is zero, the tax rate is 30 percent, and the required return on equity is 30 percent.

We show the depreciation schedule for the machinery and the income statement without any debt financing.

The TIP cash flow consists of the annual revenues, less the initial investment in Year 0, and less the annual tax payments. The annual revenues, net of taxes, are INR 375.

Next, we introduce debt financing. The annual cost of debt is 10 percent. At the end of year 0, the value of the debt is INR 600, which will be repaid in five equal annual installments. Since the cost of the machinery is INR 1,000, and the debt financing is USD 600, the remaining USD 400 will be financed by the equity holder.

Table 7.1: Depreciation Schedule for the Machinery

Depreciation Allowance 200.0

	Year	0	1	2	3	4	5
Beginning Balance			1,000.0	800.0	600.0	400.0	200.0
Depreciation Allowance			200.0	200.0	200.0	200.0	200.0
Ending Balance		1,000.0	800.0	600.0	400.0	200.0	0.0

The annual depreciation allowance is INR 200, and at the end of Year 5, the liquidation value of the machinery is zero.

Table 7.2: Income Statement without Debt Financing (in INR)

	Year	0	1	2	3	4	5
Revenues			450.0	450.0	450.0	450.0	450.0
Depreciation			200.0	200.0	200.0	200.0	200.0
EBIT			250.0	250.0	250.0	250.0	250.0
Interest Payments			0.0	0.0	0.0	0.0	0.0
EBT			250.0	250.0	250.0	250.0	250.0
Taxes			75.0	75.0	75.0	75.0	75.0
Net Income			175.0	175.0	175.0	175.0	175.0

The annual EBT (earnings before taxes) is INR 250, the annual tax payment is INR 75, based on a tax rate of 30 percent, and the annual net income is INR 175. From the income statement, we can easily obtain the TIP cash flow.

Table 7.3: Total Investment Point of View (TIP) Cash Flow

	Year	0	1	2	3	4	5
Revenues			450.0	450.0	450.0	450.0	450.0
Investment		1,000.0					
Taxes			75.0	75.0	75.0	75.0	75.0
TIP Cash Flow		-1,000.0	375.0	375.0	375.0	375.0	375.0

The loan schedule is shown below. Using the PMT function, we find that the annual equal payment for the loan is USD 158.3, and as expected, at the end of Year 5, the loan balance is zero.

Table 7.4: Loan Schedule

	Year	0	1	2	3	4	5
Beginning Balance			600.0	501.7	393.6	274.7	143.9
Interest Accrued			60.0	50.2	39.4	27.5	14.4
Payment			158.3	158.3	158.3	158.3	158.3
Ending Balance		600.0	501.7	393.6	274.7	143.9	0.0

Since the interest payments are tax deductible, we show a new income statement with debt financing.

Table 7.5: Income Statement with Debt Financing

	Year	0	1	2	3	4	5
Revenues			450.00	450.00	450.00	450.00	450.00
Depreciation			200.00	200.00	200.00	200.00	200.00
EBIT			250.00	250.00	250.00	250.00	250.00
Interest Payments			60.00	50.17	39.36	27.47	14.39
EBT			190.00	199.83	210.64	222.53	235.61
Taxes			57.00	59.95	63.19	66.76	70.68
Net Income			133.00	139.88	147.45	155.77	164.93

As expected, in each year, the taxes in the income statement with debt financing (Table 7.5) are lower than the taxes in the income statement without debt financing (Table 7.2).

Table 7.6: Cash Flow Statement, Equity Point of View

	Year	0	1	2	3	4	5
Revenues			450.0	450.0	450.0	450.0	450.0
Investment		1,000.0					
Taxes			57.0	59.9	63.2	66.8	70.7
Cash Flow to Debt		600.0	-158.3	-158.3	-158.3	-158.3	-158.3
Equity Cash Flow		-400.0	234.7	231.8	228.5	225.0	221.0
PV 30.00 %		160.02					

Next, we show the cash statement from the equity point of view. The revenues and initial investment are the same as in Table 7.3. With the interest deduction, the taxes are lower than in Table 7.3. Also, now we add the debt financing.

At the end of year 0, the loan is a cash inflow, and the repayments in years 1 to 5 are cash outflows. With respect to the end of year 0, the net present value (NPV) of the equity cash flow, discounted at the required return to equity of 30 percent, is 160.02.

Annexure 7A1:

Conducting Financial Analysis in Nominal Prices

The effects of inflation on a project's financial condition include:

- Direct impacts from changes in investment financing, cash balances, accounts receivable, accounts payable, and nominal interest rates;
- Tax impacts including interest expenses, depreciation and inventories; and
- The impact on the market exchange rate.

Inflation alters the amount and timing of the financial gains and losses of the various parties involved in a project including the owner(s), the lender(s) and the government. Correctly accounting for those changes is necessary to determine how the overall project and each of the interested parties are affected by different levels of inflation.

1. Direct Effects

(i) Investment Financing

When estimating the amount of financing an investment project requires, it is important to distinguish between two types of cost increases. First, there are cost overruns which are caused by incorrect estimates of the quantities of materials required or changes in the real prices of those materials. Second, there is cost escalation which is attributable to the general price level inflation. The "escalation" of costs that stems from pure price inflation should be recognized as normal and, if possible, should be anticipated and included in the project appraisal. If the project requires a loan or equity financing for future outlays, it should be recognized that the amount of financing needed will be affected by the amount of price inflation that takes place during the time of construction. Cost increases attributable to inflation are not overruns of real costs; therefore, additional borrowing that simply reflects the rise in the general level of prices should be planned for. If this condition is not adequately planned for at the appraisal stage, the project may experience a liquidity crisis or insolvency due to inadequate financing.

Table 7A 1.1 demonstrates the effects of inflation on investment financing. All values are given in Rupees. The project will be built during the first two time periods, operate for following four, and then be liquidated in the final time period. The total cost of construction will be

Table 7A 1.1: Project XYZ Financing

Period	0	1	2	3	4	5	6
Inflation = 0%							
1. Price Index	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2. Investment Outlays	5000	5000	0	0	0	0	0
Inflation = 25%							
3. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
4. Investment Outlays	5000	6250	0	0	0	0	0
5. Impact on Financing Requirements	0	1250	0	0	0	0	0

capitalized at the end of the second period to determine the amount to be depreciated. Loans are obtained for 50 percent of the investment in fixed assets. Loan financing will have a nominal interest rate of 5 percent per period if there is no inflation, and interest will begin accruing during the construction period. The loan principal will be repaid at the end of the last operating year of the project, period 5. The remainder of the financing requirements is covered by the owners' equity.

In this project an investment of 5000 rupees is made in fixed assets in Year 0, and if there is no inflation, a further 5000 is made in Year 1. If there is 25 percent inflation a year, the initial year's investment does not change, however the nominal investment undertaken in Year 1 increases to 6250.

When estimating the amount of financing an investment project requires, it is important to distinguish between two types of cost increases. First, there are cost overruns which are caused by incorrect estimates of the quantities of materials required or changes in the real prices of those materials. Second, there is cost escalation which is attributable to the general price level inflation. The "escalation" of costs that stems from pure price inflation should be recognized as normal and, if possible, should be anticipated and included in the project appraisal.

The presence of inflation increases the nominal amount of the investment financing required by 1250 even when there are no real increases in material needs or costs. For a 25 percent inflation rate, total nominal project costs increased from 10,000 to 11,250, or by 12.5 percent. The increased investment cost has three effects. First, it increases the interest costs to the project. Second, it increases the nominal amount of the loan principal (50 percent of nominal investment costs) which must be repaid by the project. Finally, it results in a larger nominal depreciable allowance that will be deductible from future taxes. These effects have both positive and negative cash flow impacts which are discussed below.

(ii) Desired Cash Balances

Cash balances are held by a project to facilitate transactions. An enterprise needs to maintain an amount of cash on hand that is related to the value of sales and purchases they carry out. If the demand for cash balances is a function only of the level of sales and sales remain constant with no inflation, then after initially setting aside the desired amount of operating cash, no further investments in the cash balances would be required. However, when there is inflation, the nominal values of the sales, receipts, and the cost of the goods purchased go up even if the quantities of goods bought and sold remain the same. In such a situation, the project either will have to increase its cash balances in order to conduct operations or substitute more physical resources (e.g., labor, telephone calls, etc.) to carry out these transactions.

The effects of inflation on cash balances can be demonstrated using a simple comparison of two cases. The first case shows the cash situation for a project operating in an environment where there is no inflation. Sales will be 2,000 for each period from 2 through 5, and the desired cash balance is equal to 10 percent of the nominal value of sales. Hence, given the absence of inflation, after the initial 200 is placed in the cash account, there is no need to increase that balance. The present value of the cost of holding

cash by the project is INR 41 (Table 7A1.2, line 6).

However, if the inflation rate increases to 25 percent per period, the cash balances must be increased to keep abreast of the increasing nominal value of sales. We assume for the purpose of this example that the number of units sold remains the same but their nominal value increases by 25 percent a year due to inflation. As a result, the desired stock of cash balances will increase, requiring an additional investment of cash in the project during each period if the desired level is to be maintained (Table 7A 1.3, row 4). After deflating these costs for inflation and discounting them, we find that the present value of the cost of the cash needed to run the business has increased substantially.

With zero inflation in Table 7A 1.2, the present value of the cost of holding real cash balances was -41. However, when the inflation rate is 25 percent, the present value of the cost of maintaining the same level of real cash balances will equal to -159 as shown in Table 7A 1.3, line 6. This 288 percent increase in the cost of holding cash demonstrates clearly that in an inflationary environment the need to continuously add to the stock of cash balances will add to the real costs of the project. Hence, project evaluators should incorporate a number of inflation projections in order to determine the sensitivity of total costs to the impact of inflation on the cost of holding the desired level of real cash balances.

(iii) Accounts Receivable

Accounts receivable arise from credit sales. When goods are sold and delivered but the enterprise is still awaiting payment, the value of this sale is added to accounts receivable. Such credit sales are part of the normal process of conducting business. However, in the presence of inflation, the real value of the amounts that are owed to the seller decrease the longer they are left unpaid. This creates an additional financial problem for the management of the enterprise, because they must be concerned not only with the normal risk of default but also with the fact that the receivables are falling in real value the longer they are left unpaid.

Table 7A 1.4 demonstrates the interaction between inflation and accounts receivable and the impact that interaction has on cash receipts. As the inflation rate rises, the value of sales increases due to the higher prices of the goods, even when the number of units sold remains

Table 7A 1.2: Project XYZ Cash Balance

Period	0	1	2	3	4	5	6
Inflation = 0%; Desired cash balance = 10% of sales							
1. Price Index	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2. Sales	0	0	2000	2000	2000	2000	0
3. Desired Cash Balance	0	0	200	200	200	200	0
4. Change in Cash Balance	0	0	(200)	0	0	0	200
5. Real Cash Flow Impact [4/1]	0	0	(200)	0	0	0	200
6. Present Value of Holding Cash @ 7%= (41)							

Table 7A 1.3: Cash Balance with 25% Inflation

Period	0	1	2	3	4	5	6
Inflation = 25%; Desired Cash Balance = 10% of sales							
1. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
2. Sales	0	0	3125	3906	4883	6104	0
3. Desired Cash Balance	0	0	313	391	488	610	0
4. Change in Cash Balance	0	0	(313)	(78)	(98)	(122)	610
5. Real Cash Flow Impact [4/1]	0	0	(200)	(40)	(40)	(40)	160
6. Present Value of Holding Cash @ 7% = (159)							

Table 7A 1.4: Accounts Receivable

Period	0	1	2	3	4	5	6
Inflation = 0%							
1. Sales	0	0	2000	2000	2000	2000	0
2. Accounts Receivable	0	0	400	400	400	400	0
3. Change in A/R	0	0	(400)	0	0	0	400
4. Real Receipts [1+3]	0	0	1600	2000	2000	2000	400
Inflation = 25%							
5. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
6. Sales	0	0	3125	3906	4883	6104	0
7. Accounts Receivable	0	0	625	781	977	1221	0
8. Change in A/R	0	0	(625)	(156)	(195)	(244)	1221
9. Nominal Receipts [6+8]	0	0	2500	3750	4688	5859	1221
10. Real Receipts [9/5]	0	0	1600	1921	1921	1921	321
11. Change in Real Receipts [10-4]		0	0	(79)	(79)	(79)	(79)
12. Present Value of the Change in Real Receipts @ 7% = (233)							

unchanged. This generally leads to an increase in the amount of accounts receivable. In this case, it is assumed that receivables will be equal to 20 percent of sales.

In spite of the fact that the nominal value of sales increases each period when there is 25 percent inflation, Table 7A 1.4 demonstrates that the present value of the real receipts for this project decreases by 233 due to the higher rate of inflation. This is because inflation causes the real value of outstanding trade credit to fall. When this situation arises, businesses selling goods or services (the project in this case) will attempt to reduce the length of the terms they give for trade credit, while businesses purchasing the product will have an additional incentive to delay payment. Therefore, it is important to include in a project evaluation the interaction of inflation and accounts receivable to determine how the real receipts of the business are affected by inflation.

(iv) Accounts Payable

Accounts payable represent the amount of money owed by a business to others for goods or services already purchased and delivered. When there is inflation, the buyer with the accounts payable benefits from having an outstanding balance because the real value of the obligation is falling during the period of time prior to the payment. This is simply the other side of the impact of inflation on accounts receivable because one enterprise's accounts receivable is another's accounts payable.

Table 7A 1.5 shows how inflation affects a project's financial situation when accounts payable are equal to 25 percent of annual purchases. Once again, we see that inflation increases the nominal value of purchases which leads to greater accounts payable as well.

The increased rate of inflation results in a net decrease of 155 in the present value of real expenditures. As shown in line 6, inflation increases the nominal value of purchases, and creates a corresponding increase in nominal accounts payable in line 7. When converted to real expenditures, the buyer (the project in this case) benefits from the effects of inflation on accounts payable and will have a lower overall level of expenditure, as shown in Table 7A 1.5, row 11. This gives the buyer an incentive to extend the terms of the accounts payable to benefit from their falling real value. Hence, in the presence of inflation, the longer the outstanding accounts payable are held before being paid, the greater the benefit accruing to the buyer.

(v) Nominal Interest Rates

Another way inflation alters the real net financial condition of a project is through its impact on nominal interest rates. Lenders increase the nominal interest rate on the loans they give to compensate for the anticipated loss of the real

Table 7A 1.5: Accounts Payable

Period	0	1	2	3	4	5	6
Inflation = 0%							
1. Purchases of Inputs	0	1000	1000	1000	1000	0	0
2. Accounts Payable	0	250	250	250	250	0	0
3. Change in A/P	0	(250)	0	0	0	250	0
4. Real Expenditures [1+3]	0	750	1000	1000	1000	250	0
Inflation = 25%							
5. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
6. Purchases	0	1250	1563	1953	2441	0	0
7. Accounts Payable	0	313	391	488	610	0	
8. Change in A/P	0	(313)	(78)	(98)	(122)	610	0
9. Nominal Expenditures [6+8]	0	937	1485	1855	2319	610	0
10. Real Expenditures [9/5]	0	750	951	951	951	201	0
11. Change in Real Expenditures [10-4]		0	(49)	(49)	(49)	(49)	0
12. Present Value of the Change in Real Expenditures @ 7%=(155)							

value of the loan caused by inflation. As the inflation rate increases, the nominal interest rate will be increased to ensure that the present value of the interest and principal payments will not fall below the initial value of the loan. This results in increased interest payments in the short term that compensate for the decreasing value of the loan principal over the long term.

The nominal interest rate *i* as determined by the financial markets is made up of three major components: (i) there is a factor *r* which reflects the real time value of money that lenders require in order to be willing to forego consumption or other investment opportunities; (ii) a risk factor *R* which measures the compensation the lenders demand to cover the possibility of the borrower defaulting on the loan; and (iii) a factor $(1+r+R)gP^e$ which is compensation for the expected loss in purchasing power attributable to inflation. Inflation reduces the future value of both the loan repayments and real interest rate payments. The expected rate of inflation for each period of the loan is expressed as gP^e. Combining these factors, the nominal (market) rate of interest *i* can be expressed as:

$$i = r + R + (1 + r + R)\times gP^e$$

For example, if the real interest rate (r) is 5 percent, the risk premium and inflation are zero, then the lender would charge at least 5 percent nominal interest. If the lender anticipates that the future rate of inflation (gP^e) will be 25 percent, however, then she would want to increase the nominal interest rate charged to the borrower in order to compensate for the loss in purchasing power of the future loan and interest rate payments. Maintaining the assumption that there is no risk to this loan, we can apply the following equation to determine what nominal interest rate she would need to charge to remain as well off as when there was no inflation.

$$\begin{aligned} i &= r + R + (1 + r + R)\times gP^e \\ &= (0.05) + (0) + (1+ 0.05 + 0)0.25 \\ &= 0.3125 \end{aligned}$$

Thus, the lender will need to charge a nominal interest rate of at least 31.25 percent to achieve the same level of return as in the zero inflation scenario.

For the project we are analyzing in this Part, fixed assets investments are financed 50 percent by debt and 50 percent equity. All other investments such as initial supplies are financed 100 percent by equity. In Tables 7A 7.6 and 7A 7.7, the loan schedule for the debt portion of the financing is calculated under the 0 percent and the 25 percent inflation rate scenarios.

From Table 7A 1.1, we know that the higher rate of inflation will increase both the nominal investment required and the nominal interest rate. The higher initial capital requirement must then be repaid at the higher nominal interest rate as shown in Table 7A 1.7.

Comparing Tables 7A 1.6 and 7A 1.7, we find that the present values of both loans are the same. This demonstrates that a loan with a 31.25

As the inflation rate increases, the nominal interest rate will be increased to ensure that the present value of the interest and principal payments will not fall below the initial value of the loan. This results in increased interest payments in the short term that compensate for the decreasing value of the loan principal over the long term.

Table 7A 1.6: Nominal Interest Rate of 5 percent

Period	0	1	2	3	4	5	6
Inflation = 0%							
1.Loan Principal	2500	2500	0	0	0	0	0
2. Interest	0	(125)	(250)	(250)	(250)	(250)	0
3. Loan Repayment	0	0	0	0	0	(5000)	0
4. Real Cash Flow [1+2+3]	2500	2375	(250)	(250)	(250)	(5250)	0
5. PV @ 5%= 0							

Table 7A 1.7: Nominal Interest Rate of 31.25 percent

Period	0	1	2	3	4	5	6
Inflation = 25%							
1. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
2. Loan Principal	2500	3125	0	0	0	0	0
3. Interest	0	(781.3)	(1757.8)	(1757.8)	(175.8)	(1757.8)	0
4. Loan Repayment	0	0	0	0	0	(5625)	
5. Nominal Cash Flow [2+3+4]	2500	2343.7	(1757.8)	(1757.8)	(1757.8)	(7382.8)	0
6. Real Cash Flow [5/1]	2500	1875.0	(1126.8)	(901.4)	(720.4)	(2420.6)	0

percent interest rate when inflation is 25 percent has the same present value as a loan with an interest rate of 5 percent when inflation is zero. The crucial differences are between the timing and amount of repayment. The higher nominal interest rate of 31.25 and higher inflation forces the project to repay its loans faster than if the inflation rate and nominal interest rates were lower. Table 7A 1.8 shows the difference between the project's cash flow in the two scenarios.

In real terms, the higher nominal interest rate increases the cash outflows (or reduces the net cash inflows) of the project during periods 1-4 but decreases the value of the principal that is due at the end of the project by 282.94. This is important to the evaluation of the sustainability of a project because the higher outflows during the early years of the repayment period could cause liquidity problems for the project if it is not generating sufficient cash inflows.

Effect on Tax-related Factors

Inflation has three impacts on the tax liabilities of a project. First, the higher interest payments shown in the previous section increase the amount of tax deduction that can be taken for that interest. Second, inflation reduces the value of the depreciation allowances taken for earlier investments in the project. Finally, the method used to account for inventory has an effect on the nominal earnings that are used to determine the taxable income. These three effects offset each other somewhat; however, in most cases where the impact of inflation has been studied empirically, the overall effect of inflation has been to increase tax payments significantly.

Table 7A 1.8: Comparison of Real Cash Flows

Period	0	1	2	3	4	5	6
1. 31.25% Interest with 25% Inflation	2500	1875	(1126.8)	(901.4)	(720.4)	(2420.6)	0
2. 5% Interest with 0% Inflation	2500	2375	(250.0)	(250.0)	(250.0)	(5250)	0
3. Difference in Real Cash Flow [1-2]	0	(500)	(876.8)	(651.4)	(470.4)	2829.4	0

Inflation can alter the financial feasibility of a project through the impact that increased nominal interest payments have on the income tax liabilities of the enterprise. In most countries, interest payments are deductible from income for the calculation of taxes, while principal repayments are not deductible. When the expected rate of inflation increases, nominal interest rates rise in order to compensate the lender for the loss in the purchasing power of the principal outstanding and future interest payments.

(i) Interest Deduction

Inflation can alter the financial feasibility of a project through the impact that increased nominal interest payments have on the income tax liabilities of the enterprise. In most countries, interest payments are deductible from income for the calculation of taxes, while principal repayments are not deductible. When the expected rate of inflation increases, nominal interest rates rise in order to compensate the lender for the loss in the purchasing power of the principal outstanding and future interest payments. Table 7A 1.9 shows how inflation, through the way it converts some of the real value of the principal repayments into interest payments, causes tax payments to fall. The higher nominal interest payments are deductible from taxable income, hence they serve to reduce the amount of taxes which the project would otherwise be required to pay.

(ii) Depreciation Allowance

Another factor affected by inflation is the real value of the depreciation allowances for capital goods which are deductible for income tax purposes. Most countries base the deductions for depreciation expense (capital cost allowances) on the original nominal cost of the depreciable assets. If inflation increases, then the relative value of this deduction will fall causing the real amount of income tax liabilities to increase. In Table 7A 1.10, we see that a 25 percent rate of inflation causes the tax savings from depreciation expense deductions to fall by 1090. This is equal to approximately 10 percent of the real value of the fixed assets being depreciated.

(iii) Inventory Accounting

(a) First-in-first-out (FIFO)

Further tax implications of inflation are experienced by enterprises which must account for inventories of inputs and outputs. In many countries to determine the amount of taxable profit enterprises are required to value inventories in their accounts on a first-in-first-out basis (FIFO). This means that the price of the oldest inventories (first in) is the value which is used to determine the cost of the goods sold (COGS). The difference between the COGS and the sale price is the taxable revenue from the project.

Table 7A 1.9: Interest Expense

Income Tax Rate = 30%							
Period	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Inflation = 0%; Nominal Interest = 5%							
1. Interest Expense	0	(125)	(250)	(250)	(250)	(250)	0
2. Real Tax Savings [Row 1*.3]	0	37.5	75	75	75	75	0
Inflation = 25%; Nominal Interest = 31%							
3. Interest Expense	0	(781.3)	(1758)	(1758)	(1758)	(1758)	0
4. Tax Savings [Row 3*0.3]	0	234	527	527	527	527	0
5. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
6. Real Tax Savings [4/5]	0	187.2	337.8	270.3	215.9	172.8	0
7. Change in Tax Savings [6-2]	0	149.7	262.8	195.3	140.9	97.8	0
8. PV of Increased Tax Savings @ 7% = 706							

Table 7A 1.10: Project XYZ: Depreciation Allowance

Straight Line Depreciation Over 4 periods; Income Tax Rate = 30%							
Period	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Inflation = 0%; Depreciable Investment = 10000							
1. Depreciation	0	0	2,500	2,500	2,500	2,500	0
2. Real Tax Savings [Row 1*0.3]	0	0	750	750	750	750	0
Inflation = 25%; Nominal Depreciable Investment = 11250							
3. Depreciation	0	0	2812.5	2812.5	2812.5	2812.5	0
4. Tax Savings [Row 3*0.3]	0	0	844	844	844	844	0
5. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
6. Real Tax Savings [4/5]	0	0	541	433	346	276	0
7. Change in Real Tax Savings [6-2]	0	(209)	(317)	(404)	(474)	0	
8. PV of Change in Real Tax Savings @ 7% = (1090)							

Taxable revenue generally increases by the rate of inflation because sale prices are affected immediately by the rate of inflation, while the costs of goods sold from inventories are valued using prices of a previous period when the nominal prices were presumably lower. For example, if the project has a one year inventory of final goods at the beginning of the year and the inflation rate for that year is 25 percent, then nominal cost prices of the goods sold will be 25 percent lower than their selling prices one year later, even if no profit margin is added. The result is that the measured profits are artificially inflated which increases the tax burden in both

nominal and real terms.[20] From Table 7A 1.11, lines 1-14, we see that by increasing the rate of inflation from 0 to 25 percent, the present value of real tax payments increases by 193.

(b) Last-in-first-out (LIFO)

Another method for accounting for the cost of goods sold is known as last-in-first-out (LIFO). As the name implies, the most recent goods purchased (last in) are used to measure the cost of goods sold (first out), and the prices of the project inputs are generally increasing at the same rate of inflation as the outputs sold. During the production cycle of a project, this is a benefit because the profits are not increased artificially by the presence of inflation. It also means that taxes will be lower as a result. However, LIFO has a negative aspect as well because as the activity winds down, or the level of inventories is reduced due to business conditions, the lower prices of the goods that were purchased in earlier years are now used to calculate the cost of goods sold, resulting in inflated profits and increased taxes as shown in Table 7A 1.12, row 13 — period 5.

The LIFO system for accounting for cost of goods sold allowed tax liabilities to remain unaltered until period 5. As the project winds down, the prices used to calculate the COGS for that period are now from period one. Hence, with 25 percent inflation profits in period five will be

Table 7A 1.11: Inventory and Cost of Goods Sold — FIFO

Income Tax Rate = 30%							
Period	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Inflation = 0%							
1. Sales	0	0	2,000	2,000	2,000	2,000	0
2. Purchase of Inputs	0	1,000	1,000	1,000	1,000	0	0
3. COGS	0	0	1,000	1,000	1,000	1,000	
4. Measured Profits [1 - 3]	0	0	1,000	1,000	1,000	1,000	0
5. Real Tax Liability [4*0.3]	0	0	300	300	300	300	0
Inflation = 25%							
6. Sales	0	0	3,125	3,906	4,883	6,104	0
7. Purchase of Inputs	0	1,250	1,563	1,953	2,441	0	0
8. COGS	0	0	1,250	1,563	1,953	2,441	0
9. Measured Profits [6 - 8]	0	0	1,875	2,343	2,930	3,663	0
10. Nominal Tax Liability	0	0	563	703	879	1,099	0
11. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
12. Real Tax Liability [10/11]	0	0	361	361	361	361	0
13. Change in Tax Liability [12-5]	0	0	61	61	61	61	0
14. PV of Change in Tax Liability @ 7% = 193							

[20] This occurs because, in a period of rapid inflation, the historical cost of inventories now being used in production will be substantially less than the current replacement cost of these items. If taxable income is calculated using the historical cost of the inventory items, the real cost of goods will be underestimated and taxable income will be overestimated. Therefore, real income tax liabilities will be greater than they would be if no inflation had existed.

greatly inflated, causing the tax burden to increase in real terms by 177 (line 13 — period 5) over the no inflation scenario.

Comparing the effects of inflation on the tax liability in the FIFO and LIFO accounting systems, we see that in both cases, inflation increased the taxes. With FIFO and 25 percent inflation the present value of the tax liability increased by 193 (Table 7A 1.11), and with LIFO, the present value increased by 126 (Table 7A 1.12).

In addition to the cost difference, the timing of the tax burden is substantially different. Using FIFO, inflation increased the taxes in each period, whereas using LIFO resulted in no increase in taxes in the production period but in a larger tax liability in the last sales period. LIFO defers the increased tax burden attributable to inflation until a period when there is a need to lower the level of inventories. As the lower priced inventories are drawn into the cost of goods sold, the difference between inflated sales values and older prices generates larger profits and increases the tax liability. Using LIFO could increase the overall risk associated with the project in a high inflation environment if the reason for the enterprise wanting to lower the level of inventories was financial stress or business slow down. In such a situation, the increased tax liability is concentrated in a few periods when the project is already facing problems, while with FIFO the increased tax liability is spread out over each operating period. Hence, when doing the appraisal it is important to consider the type of accounting rules used for determining the cost of goods sold to assess how inflation might affect both the timing and quantity of the tax liabilities to be paid by the project.

Table 7A 1.12: Inventory and Cost of Goods Sold — LIFO

Income Tax Rate = 30%							
Period	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Inflation = 0%							
1. Sales	0	0	2,000	2,000	2,000	2,000	0
2. Purchase of Inputs	0	1,000	1,000	1,000	1,000	0	0
3. COGS	0	0	1,000	1,000	1,000	1,000	
4. Measured Profits [1-3]	0	0	1,000	1,000	1,000	1,000	0
5. Real Tax Liability [4*0.3]	0	0	300	300	300	300	0
Inflation = 25%							
6. Sales	0	0	3,125	3,906	4,883	6,104	0
7. Purchase of Inputs	0	1,250	1,563	1,953	2,441	0	0
8. COGS	0	0	1,563	1,953	2,441	1,250	0
9. Measured Profits [6-8]	0	0	1,562	1,953	2,441	4,854	0
10. Nominal Tax Liability	0	0	469	586	732	1,456	0
11. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
12. Real Tax Liability [10/11]	0	0	300	300	300	477	0
13. Change in Tax Liability [12-5]	0	0	0	0	0	177	0
14. PV of Change in Taxes Due @ 7% =126							

Annexure 7A2:

Foundations of Risk Analysis

Introduction

To conduct risk analysis in project appraisal, it is necessary to understand some basic concepts in probability and statistics. In the table of parameters for the construction of the model for project appraisal, we list the expected values for the variables, with the clear understanding that there is uncertainty about these values. The variability and uncertainty in the parameters means that there will also be variability in the desired outcomes, such as the NPV of the project from different points of view.

Table 7A 2.1: Values and Probabilities for the Output Price, with Equal Probabilities

Output Price	Probability
10	1/3
12	1/3
14	1/3

How do we model and understand the uncertainty in the variables and the desired outcomes? We use the theory of probability and statistics.

Consider a simple numerical example. Suppose we believe that the output price can take on only three possible discrete values: USD 10, USD 12 and USD 14. This is clearly an unrealistic example because in practice there will be a whole range of values for the output price rather than just three values. Nevertheless, for getting a grasp of the basic ideas, the simple example is a good place.

To conduct risk analysis in project appraisal, it is necessary to understand some basic concepts in probability and statistics. In the table of parameters for the construction of the model for project appraisal, we list the expected values for the variables, with the clear understanding that there is uncertainty about these values. The variability and uncertainty in the parameters means that there will also be variability in the desired outcomes.

Next, we ask the question: what is the likelihood that each of these prices will occur? We have to assign probabilities for each of the prices. Since the three prices are the only possibilities, the sum of the probabilities for the three prices must equal one.

For simplicity, we can assume that all the prices are equally likely, in which case, the probability for each price is one-third. With the knowledge of the values and probabilities for the prices, we can calculate the expected value of the output price. Let P_i represent the ith price, and let $Prob(P_i)$ represent the probability of the ith price. Then the expected value equals the sum of each price times its corresponding probability. For this example, the expected value of the price is USD 12.

Expected value of the output price

$$= P_1 \times Prob(P_1) + P_2 \times Prob(P_2) + P_3 \times Prob(P_3)$$
$$= 10 \times 1/3 + 12 \times 1/3 + 14 \times 1/3 = \mathbf{12.00} \qquad (1)$$

Measure of Central Tendency

The expected value is a measure of the central tendency of the output price. Other common names for the expected value are "average value" or "mean value." In the above example, the discrete probability distribution for the output price is symmetric. The lower price of USD 10 and the higher price of USD 14 are equidistant from the mean value of USD 12.

Next, consider a different set of output prices as follows. Again, we assume that all of the three values for the output price are equally likely.

Table 7A 2.2: Values and Probabilities for the Output Price, with Equal Probabilities

Output Price	Probability
8	1/3
12	1/3
16	1/3

What is the expected value in this case?

In this case, the expected value of the price is again USD 12.

Expected value of the output price

$$= P_1 \times Prob(P_1) + P_2 \times Prob(P_2) + P_3 \times Prob(P_3)$$
$$= 8 \times 1/3 + 12 \times 1/3 + 16 \times 1/3 = \mathbf{12.00} \qquad (2)$$

Let X_i be the ith price. Suppose there are N discrete prices and each price is equally likely. Then the probability for each price is 1/N. The general formula for the expected value is as follows:

$$\text{Expected value} = \Sigma X_i/N \ \forall \ i = 1 \text{ to } N \qquad (3)$$

Measure of Dispersion

How about the variability in the price? How would we compare the variability of the set of output prices in Table 7A 2.2 with the variability of the set of output prices in Table 7A1.1? To compare the variability, we need to define a measure for the variability. The variance is common measure of variability or dispersion of the output price. How do we calculate the variance?

We use the following steps. First, we calculate the deviation of each of the prices from the average price. This is known as the "deviation from the mean."

Second, we square each of the deviations from the mean.

Third, we take the average of all of the deviations from the mean.

Table 7A 2.3: Calculation of the Variance of the Output Price in Table 7A 2.1

	Price	Price - AvgP	(Price - AvgP) Sq
	10	-2.0	4.0
	12	0.0	0.0
	14	2.0	4.0
# of Observations	3	3	3
Average	12		

For the price of USD 10, the deviation of this price from the expected price is -2; for the price of USD 12, the deviation is zero, and for the price of USD 14 the deviation is +2. Notice that if we were to use the sum of the deviations from the mean as a measure of the dispersion, we would obtain a value of zero. Clearly in this case, the dispersion of the price is not zero, and thus it would not make sense to use the sum of the deviations from the mean as a measure of dispersion. Instead, we square each of the deviations from the mean, and take the average.

$$\text{Variance} = ((10 - 12)^2 + (12 - 12)^2 + (14 - 12)^2)/3$$
$$= \mathbf{2.67} \qquad (4.1)$$

$$\text{Standard deviation} = \mathbf{1.63} \qquad (4.2)$$

Since we squared the deviations from the mean to obtain the variance, the unit for the variance is the square of the price. Thus, we define the standard deviation as the square root of the variance, and use the standard deviation as a measure of the dispersion. Thus, the standard deviation for the output prices in Table 7A 2.1 is 1.63.

Using the same procedure, we calculate the variance of the output price in Table 7A 2.2. In

this case, the variance is and the standard deviation is 3.27.

Table 7A2.4: Calculation of the Variance of the Output Price in Table 7A 2.2

	Price	Price - AvgP	(Price - AvgP) Sq
	8	-4.0	16.0
	12	0.0	0.0
	16	4.0	16.0
# of Observations	3.0	3	3
Average	12.0		

Variance = $((8 - 12)^2 + (12 - 12)^2 + (16 - 12)^2)/3 =$ **10.67** (5.1)

Standard deviation = **3.27** (5.2)

In this case, the standard deviation is 3.27. And as expected, the dispersion of the output price in Table 7A 2.2 in greater than the dispersion of the output price in Table 7A 2.1.

Let X_i be the ith price. Suppose there are N discrete prices and each price is equally likely. Then the probability for each price is 1/N. The general formula for the variance is as follows.

$$\text{Variance} = \Sigma (X_i - \mu)^2/N \ \forall\ i = 1 \text{ to } N \qquad (6)$$

Example with Unequal Probabilities

It is not necessary that all of the values for the prices are equally likely. For example, it may be the case that the probability for the price equal to USD 12 is 50 percent, and the probability for each of the other prices is 25 percent.

In this case, again the expected value of the price is USD 12.

Expected value of the output price

$$= P_1 \times \text{Prob}(P_1) + P_2 \times \text{Prob}(P_2) + P_3 \times \text{Prob}(P_3)$$
$$= 10\times 25\% + 12\times 50\% + 14\times 25\% = \mathbf{12.00} \qquad (7)$$

Table 7A 2.5: Values and Probabilities for the Output Price, with Unequal Probabilities

Output Price	Probability
10	25%
12	50%
14	25%

Continuous Probability Distributions

In this section, we discuss three common continuous probability distributions: the uniform distribution, the triangular distribution and the normal (Gaussian) distribution.

Uniform Distribution

The uniform distribution is the easiest to understand. Suppose we believe that the output price is uniformly distributed between USD 10 and USD 30. Compared to the previous discrete examples with three values for the output price, what is the meaning of the uniform distribution? We briefly discuss some of the properties of the uniform distribution. First, the output price can take on any value between the two endpoints of USD 10 and USD 30; and there is zero probability that the price is less than USD 10, and also zero probability that the price is more than USD 30. Even though in reality the output price could occur outside of the two endpoints, in some cases, the uniform probability distribution may be a reasonable specification.

Second, with a continuous probability distribution, there is zero probability of a single price occurring. Thus it makes no sense to mention a single-valued price. We must mention a continuous range of values. For example, we

cannot ask the question: what is the probability that the price is USD 10? We have to ask the question: what is the probability that the price is less than USD 11? In other words, what is the probability that the price is between USD 10 and USD 11?

The graph of this uniform probability distribution is shown below.

For a continuous probability distribution, the total area under the graph for the probability distribution must equal one.

Based on this property, what should be the height of the graph?

(Maximum value – minimum value)×height = 1 (8)

Thus, the height must be 5 percent since the difference between the maximum and minimum value is 20.

Now, we can ask some questions about the uniform probability distribution.

What is the probability that the output price will be between USD 15 and USD 20?

To calculate the answer, we have to the area of the rectangle between the two endpoints and the Figure of the uniform probability distribution. The probability is 25 percent that the output price is between USD 15 and USD 20.

Probability = 5%×(20 – 15) = **25.0%** (9)

What is the probability that the output price will be between USD 25 and USD 28?

The probability is 15 percent that the output price is between USD 25 and USD 28.

Probability = 5%×(28 – 25) = **15.0%** (10)

What is the probability that the output price will be between USD 21 and USD 28?

The probability is 35 percent that the output price is between USD 21 and USD 28.

Probability = 5%×(28 – 21) = **35.0%** (11)

For the uniform probability distribution, it is particularly easy because Figure of the uniform probability distribution is a horizontal line. For other probability distributions, such as the triangular or normal, it is not as easy.

Cumulative Uniform Probability Distribution

For the uniform probability distribution, we can easily graph the cumulative probability distribution. In this case, the cumulative probability distribution is a straight line with a slope of one-twentieth.

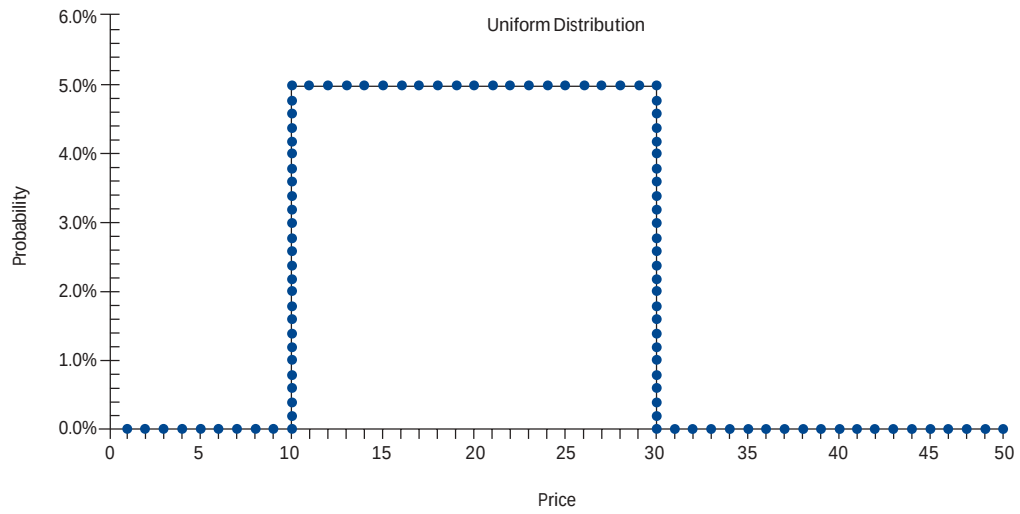
To find the cumulative probability from the lower endpoint to any desired value for the price, select the desired value for the price and go up to Figure 7A 2.1 for the cumulative probability distribution and read off the cumulative probability from the vertical axis.

Custom (or Step) Distribution

Another common probability is the step distribution.

In this case, we specify the probability for different ranges of value. Consider the following

Figure 7A 2.1: Graph of Uniform Probability Distribution



(symmetric) step distribution for the output price. Between USD 10 and USD 20, the output price is uniformly distributed, the cumulative probability is 20 percent, and the height of the graph line is 2 percent.

Between USD 20 and USD 35, the output price is uniformly distributed, the cumulative probability is 60 percent, and the height of the graph line is 4 percent. Between USD 35 and USD 45, the output price is uniformly distributed, the cumulative probability is 20 percent, and the height of the graph line is 2 percent.

Table 7A 2.6: Cumulative Probabilities for Step Distributions

Output Price	Cumulative Probability
10	
20	20%
35	60%
45	20%

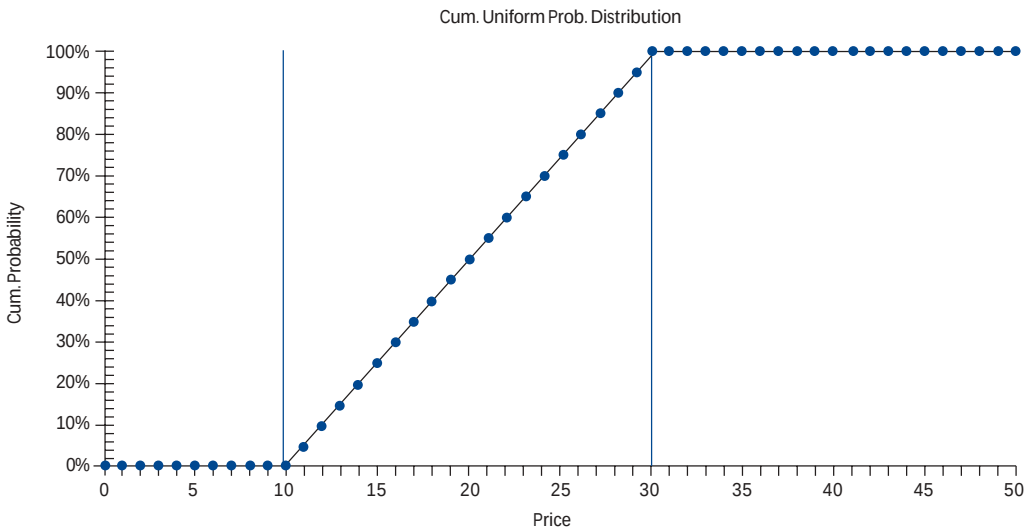
Triangular Distribution

In some case the triangular distribution may be suitable. The triangular distribution may be symmetric or nonsymmetric. For a symmetric triangular distribution, the peak is the midpoint of the maximum and minimum values.

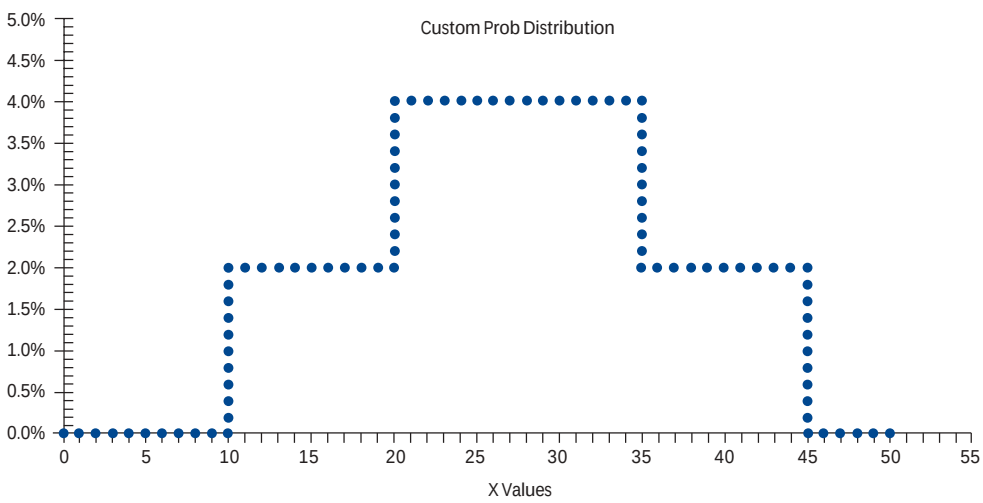
Normal (Gaussian) Distribution

The normal distribution is the familiar bell-shaped probability distribution. It is one of the most useful and widely used probability distribution. We present and discuss some well-known properties of the normal distribution. The normal distribution is fully characterized by the mean and standard deviation. In other words, if we know the mean and standard deviation of any normal distribution, we can calculate the probability for any range of values. Suppose we assume that the unit price of the output X follows a normal distribution with a mean value of USD 100 and a standard deviation of USD 20. We write this as follows. The symbol ~ stands for

Figure 7A 2.2: Cumulative Uniform Probability Distribution



Graph 7A 2.3: Insert Graph for Custom Step Distribution



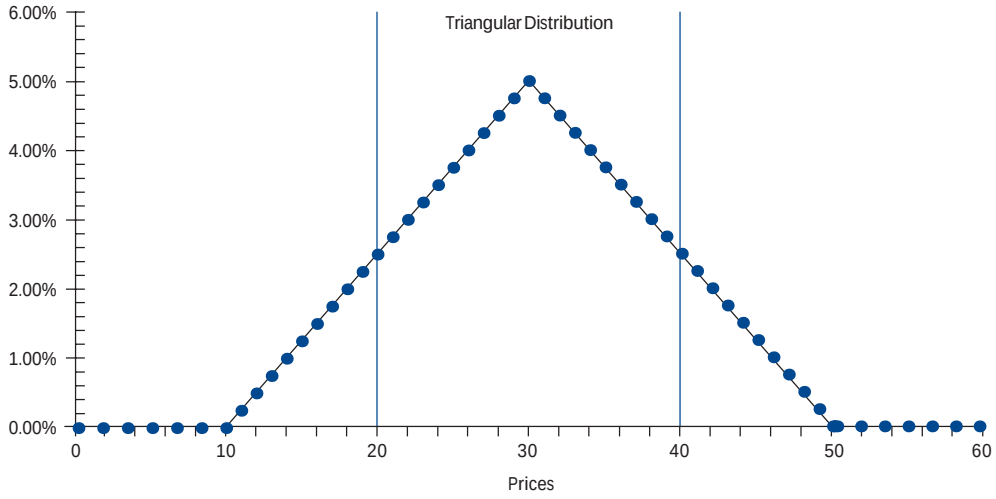
"distributed as" and N stands for normal distribution. The first parameter in parenthesis is the mean value and the second parameter is the variance.

$X \sim N(100,20^2)$

We must note that the normal distribution does not fully fit the price variable.

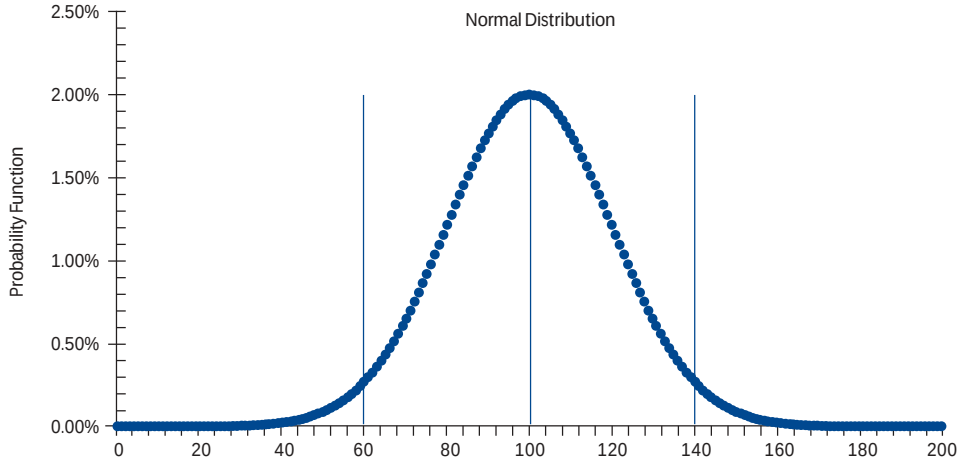
For example, the normal distribution ranges from minus infinity to plus infinity. Clearly, the price cannot take negative values and there is some upper limit to the price. Nevertheless, for practical purposes, the normal distribution is convenient to use and appropriate.

Figure 7A 2.4: Insert Graph for Triangular Distribution



The two endpoints of the triangle determine the range of values for the price.

Figure 7A 2.5: Graph for the Normal Distribution



With the normal distribution there are some well-known rules about the probability between given ranges of values.

Rule One Sigma

We can ask the question: what is the probability that the output price is **within** one standard deviation of the mean? In other words, what is the probability that the price X is between 80, which is one standard deviation (or one sigma) below the mean and 120, which is one standard deviation above the mean? The answer, for any normal distribution, is 68 percent.

Prob ($\mu - \sigma \leq X\ \mu \leq + \sigma$) = Prob ($100 - 20 \leq X \leq 100 + 20$)

$= \text{Prob}\ (80 \leq X \leq 120) = 68\%$ (12)

Rule Two Sigma

What about the probability that the price is **within** two standard deviations of the mean? In other words, what is the probability that the price is between 60, which is two standard deviations (or two sigmas) below the mean and 120, which is two standard deviations above the mean? The answer, for any normal distribution, is 95 percent.

$\text{Prob}\ (\mu - 2\sigma \leq X \leq \mu + 2\sigma) = \text{Prob}\ (100 - 2\times20 \leq X \leq 100 + 2\times20)$
$= \text{Prob}\ (60 \leq X \leq 140) = 95\%$ (13)

Rule Three Sigma

What about the probability that the price is **within** three standard deviations of the mean? For any normal distribution, the probability is 99 percent that the price is within three standard deviations of the mean.

$\text{Prob}\ (\mu - 3\sigma \leq X \leq \mu + 3\sigma) = \text{Prob}\ (100 - 3\times20 \leq X \leq 100 + 3\times20)$
$= \text{Prob}\ (40 \leq X \leq 160) = 99\%$ (14)

Based on these three rules about one, two and three sigma, we can answer the following additional questions for a normal distribution.

What is the probability that the output price X is above USD 120? In other words, what is the probability that the output price X is one standard deviation **above** the mean?

$\text{Prob}\ (X \geq \mu + \sigma) = \text{Prob}\ (X \geq 100 + 20)$
$= \text{Prob}\ (X \geq 120) = ?$

From the rule one sigma, we know the following.

$\text{Prob}\ (\mu - \sigma \leq X \leq \mu + \sigma) = \text{Prob}\ (100 - 20 \leq X \leq 100 + 20)$
$= \text{Prob}\ (80 \leq X \leq 120) = 68\%$ (15)

The probability that the output price is more than 2 standard deviations from the mean (in absolute value terms) is 32 percent. In other words, the combined probability that X is either one standard deviation below the mean or one standard deviation above the mean is 32 percent.

$\text{Prob}\ (X \leq \mu - \sigma)$ or $\text{Prob}\ (X \geq \mu + \sigma) = 100\% - 68\% =$ **32.0%**

(16)

Since the normal probability distribution is symmetric, it means that the probability of the lower tail equals the probability of the upper tail of the probability distribution. Thus, the probability that the output price is one standard deviation above the mean is 16 percent.

$\text{Prob}\ (X \geq 120) = 32\%/2 =$ **16.0%** (17)

What is the probability that the output price X is below USD 140? In other words, what is the probability that the output price X is two standard deviations **below** the mean?

$\text{Prob}\ (X \leq \mu - 2\sigma) = \text{Prob}\ (X \leq 100 - 40) = \text{Prob}\ (X \leq 60) = ?$

From the rule two sigma, we know the following.

$\text{Prob}\ (\mu - 2\sigma \leq X \leq \mu + 2\sigma) = \text{Prob}\ (100 - 2\times20 \leq X \leq 100 + 2\times20)$
$= \text{Prob}\ (60 \leq X \leq 140) = 95\%$ (18)

The probability that the output price is more than 2 standard deviations from the mean (in absolute value terms) is 95 percent. In other words, the combined probability that X is either two standard deviations below the mean or two standard deviations above the mean is 5 percent.

$$\text{Prob}(X \le \mu - 2\sigma) \text{ or } \text{Prob}(X \ge \mu + 2\sigma) = 100\% - 95\% = \mathbf{5.0\%} \quad (19)$$

Since the normal probability distribution is symmetric, it means that the probability of the lower tail equals the probability of the upper tail of the probability distribution. Thus, the probability that the output price is one standard deviation above the mean is 2.5 percent.

$$\text{Prob}(X \le 60) = 5\%/2 = \mathbf{2.5\%} \quad (20)$$

What is the probability that the output price X is between USD 80 and USD 140? In other words, what is the probability that the output price X is between one standard deviation below the mean and two standard deviations **above** the mean?

$$\text{Prob}(\mu - \sigma \le X \le \mu + 2\sigma) = \text{Prob}(100 - 20 \le X \le 100 + 2\times 20)$$
$$= \text{Prob}(80 \le X \le 140) = ?$$

To answer this question, we can rewrite it as the sum of two probabilities, namely the probability between one standard deviation below the mean and the mean plus the probability between the mean and two standard deviations above the mean.

$$\text{Prob}(\mu - \sigma \le X \le \mu + 2\sigma) = \text{Prob}(\mu - \sigma \le X \le \mu) + \text{Prob}(\mu \le X \le \mu + 2\sigma)$$
$$= \text{Prob}(80 \le X \le 100) + \text{Prob}(100 \le X \le 140) \quad (21)$$

The probability between one standard deviation below the mean and the mean is 34 percent.

$$\text{Prob}(\mu - \sigma \le X \le \mu) = \text{Prob}(80 \le X \le 100) = 34\% \quad (22)$$

The probability between the mean and two standard deviations above the mean is 2.5 percent.

$$\text{Prob}(\mu \le X \le \mu + 2\sigma) = \text{Prob}(100 \le X \le 140) = 50\% - 2.5\% = 47.5\% \quad (23)$$

Thus, the combined probability is 81.5 percent.

$$\text{Prob}(\mu - \sigma \le X \le \mu + 2\sigma) = 34\% + 47.5\% = \mathbf{81.5\%} \quad (24)$$

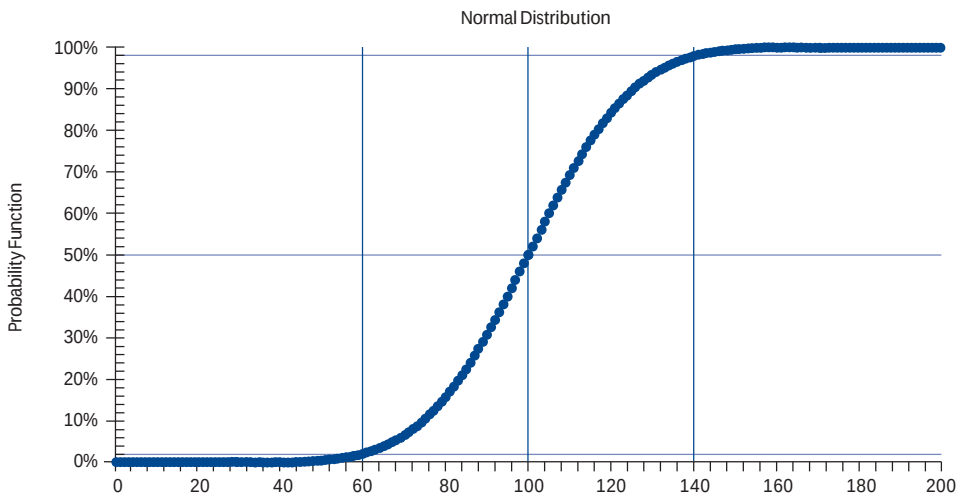
Cumulative Normal Probability Distribution

Next, we discuss the cumulative normal probability distribution. The vertical axis of the cumulative distribution shows the cumulative probability.

The Cumulative Probability Distribution from Monte Carlo Simulation

The risk analysis with the Monte Carlo Simulation generates the cumulative probability distribution for the desired outcomes of the project, such as the NPVs from different points of view. The cumulative probability distribution is useful for decision making. From the cumulative probability distribution, we can easily read off the probability that the NPV of the project will be negative.

Figure 7A 2.6: Graph for the Cumulative Normal Distribution



To find the cumulative probability distribution, we go from the desired horizontal value to the graph and read the cumulative probability off the vertical axis.

Correlations Between Variables

Next, we discuss correlations between variables. Consider two variables, the price of the output X and the quantity of output Y. Let $\grave{\imath}_X$ be the expected value for X, and let $\grave{\imath}_Y$ be the expected value for Y. It is reasonable to assume that there is a negative relationship between these two variables. The measure of the strength of the relationship between two variables X and Y is the covariance. The formula for the covariance is as follows.

$$\text{Covariance} = \Sigma (X_i - \mu_X)(Y_i - \mu_Y)/N \quad \forall\ i = 1 \text{ to } N \qquad (25)$$

We illustrate the use of this formula with a simple numerical example.

First, we calculate the deviation of the X values from the expected X value, and the deviation of the Y values from the expected Y value. Second, we multiply the deviation of the ith X value and the corresponding deviation for the ith Y value. Third, we take the average.

$$\text{Covariance} = (-2\times4 + 0\times0 + 2\times-4)/3 = \mathbf{-2.67} \qquad (26)$$

We cannot use the covariance measure to compare the strength of the relationships between pairs of variables because the units for the covariance are the product of the units for the two variables.

We define the correlation coefficient as follows. The correlation coefficient equals the covariance divided by the product of the standard deviation of X and the standard deviation of Y.

$$\text{Correl}\ (X,Y) = \text{Covariance}\ (X,Y)/(\mu_X\times\mu_Y) = \mathbf{-2.67}/(1.633\times3.266) = \mathbf{-0.50} \qquad (27)$$

In this case, the correlation coefficient between X and Y is -0.50. By definition, if the two variables

are perfectly positively correlated, the maximum value for the correlation coefficient is +1; if the two variables are perfectly negatively correlated, the minimum value for the correlation coefficient is -1.

If the two variables are perfectly positively correlated, it means that the values of X equal the values of Y. The formula for the covariance in the numerator is identical to the formula for the variance, and the product in the denominator also equals the variance. Thus the maximum possible value is +1. If the two variables are perfectly negatively correlated, it means that the values of X equal the negative of the values of Y. And thus, the minimum possible value is -1.

Table 7A 2.7: Calculation of the Covariance of the Output Price and Quantity

	Price X	Quantity Y	(X - AvgX) Sq	(Y - AvgY) Sq	Product
	10	24	-2.0	4.0	-8.0
	12	20	0.0	0.0	0.0
	14	16	2.0	-4.0	-8.0
# of Observations	3.0	3.0			
Average	12.0	20.0			
Std. Dev.	1.633	3.266			

Annexure 7A3:

Principles of Risk Analysis and Management

In this Annexure, we present the principles of risk analysis and management. Risk analysis and management are integral components of the project appraisal framework. In the previous discussion on the construction of the financial and economic cash flow statements, we postponed the issue of uncertainty and simply specified the expected values for the key variables in the table of parameters. Based on these expected values, in the subsequent tables of the project appraisal, we entered formulas that were linked to the key variables in the table of parameters. It is extremely important that the formulas are properly linked. If the formulas for the desired outcomes, such as the NPVs from the different points of view, are not properly linked, then it would not be possible to conduct risk analysis.

In the risk analysis, we introduce uncertainty explicitly into the project appraisal and analyze the risk profiles of the nominal cash flows from different points of view. After we have a good understanding of the risk profiles of the cash flows from different points of view, we move forward and examine the issue of risk diversification and management. The risk analysis enables us to identify and focus on the key variables on which we may wish to acquire better information.

In the risk analysis, first, we identify, analyze and interpret the expected variability in the desired project outcomes from alternative points of view. We discuss sensitivity analysis, scenario analysis and Monte Carlo Simulation (MCS).

Second, we discuss the sources of risk and the issue of risk diversification, using some simple variance relationships.

Third, we examine how we can redesign and reorganize the project to allocate, and if necessary reallocate, the risk in a more efficient manner.

Risk Analysis

The motivation and necessity for risk analysis is straightforward. As mentioned earlier, there is uncertainty in the values of the key variables that we list in the table of parameters for the project appraisal. The variability in the key variables affects the desired outcomes, such as the Net Present Value (NPV) of the project from different points of view. Thus we have to examine how changes in the values of the key variables impact the desired outcomes. With the results of this analysis, we can examine issues in risk management and the design of contracts for risk allocation.

Since the nominal cash flow profiles for a project extend over many years, there is uncertainty both at a given point in time and across time. For example, in a given year, there may be variability in the unit price of the output. Also, we recognize that the unit price of the output may change over time, in which case we have to model the correlations, if any, between prices over time.

There are alternative methods for risk analysis, ranging from the simple to the complex.

1. Sensitivity analysis.
2. Scenario analysis.
3. Monte Carlo Simulation (MCS).

Below, we describe each of the three methods.

Sensitivity Analysis

In the table of parameters for a project appraisal, we list the expected values for the key variables, with the recognition that there is uncertainty about the values for the variables. In the sensitivity analysis, we examine how changes in the values of one of these variables, holding constant the values of all of the variables, affect the NPV of the net cash flow. Sensitivity analysis is also known as "what-if" analysis.

In Excel, it is easy to create simple one-way and two-way tables (sensitivity tables) that show how changes in the value of a certain variable impact on the NPV of the project, *ceteris paribus* (holding constant the values of all the other variables). The generation of the one-way tables requires that the cells for the desired outcomes are properly linked to the variables in the table of parameters. It is very important to keep in mind the *ceteris paribus* condition. As we discuss later, we must recognize that in reality many variables are changing simultaneously.

In the risk analysis, we introduce uncertainty explicitly into the project appraisal and analyze the risk profiles of the nominal cash flows from different points of view. After we have a good understanding of the risk profiles of the cash flows from different points of view, we move forward and examine the issue of risk diversification and management.

Also, with sensitivity analysis, we can conduct break-even analysis for each of the key variables. For example, we can determine the output price that will cause the NPV of the project to switch from positive to negative. The break-even values for each of the key variables will provide a qualitative assessment of the extent to which the project is responsive to changes in the values of the key variables.

Furthermore, sensitivity analysis is a powerful diagnostic tool for assessing the construction of the overall financial models. For many variables, we know the direction of the impact of changes in the value of the variable on the desired outcomes. For example, generally speaking, an increase in the expected inflation rate should have a negative impact on the NPV of the project, taking into account all the direct and indirect effects of inflation. If the sensitivity analysis reveals that an increase in the expected inflation rate leads to an increase in the NPV of the project, it is most likely that there is an error in the modeling. If there is no error, then the analyst should be able to identify the reason(s) why inflation is creating value.

We illustrate the ideas and concepts of sensitivity analysis with the following simple numerical example. Suppose a project sells 10 units each year, and at the end of year 0, the unit price is INR 20, which increases at the expected inflation rate of 5 percent. The real discount rate is 10 percent, and with an expected inflation rate of 5 percent, the nominal discount rate is 15.5 percent.

First, we construct the inflation index, and obtain the nominal price profile by multiplying the initial unit price in year 0 with the expected inflation index.

Thus, in Year 5, the nominal unit price is INR 25.53. In any year, the revenues equal the nominal price for that year times the quantity of output.

The annual accounts receivable in years 1 to 4, as a percentage of the revenues, is 20 percent. In Year 5, the accounts receivable is zero.

In any year, the net cash flow equals the sum of the annual revenues and the change in accounts receivable. With these assumptions, the present value (PV) of the net cash flow for the project with respect to the end of year 0, at a discount rate of 15.5 percent, is USD 593.3. Thus, the PV of the net cash flow is USD 593.3, if all of the values that we have specified for the variables occur simultaneously, namely the output is 10 units, the initial output price in year 0 is USD 20, the accounts receivable is 20 percent, and the expected inflation rate is 5 percent. As noted earlier, we know that there is variability in the values of these four variables, and it is extremely unlikely that the specified values for the four variables will occur simultaneously to give the NPV of USD 593.3. Thus, the single value estimate of the NPV of the project is not very useful for decision-making. The variability in the values of the variables means that there will be variability in the NPV of the project, depending on the values that occur for the variables. This suggests that we need to model the variability in the desired outcomes.

In this numerical example, we conduct sensitivity analysis with the following variables on the PV of the net cash flow: the quantity of output, the initial output price in Year 0, the accounts receivable and the expected inflation rate.

Impact of Changes in the Quantity of Output on the PV of the Net Cash Flow

Table 7A 3.4 shows the sensitivity analysis of the quantity of output on the PV of the net cash flow.

Table 7A 3.1: Inflation Index and Nominal Price Profile

	Year	0	1	2	3	4	5
Inflation Index		1.000	1.050	1.103	1.158	1.216	1.276
Nominal Unit Price		21.00	22.05	23.15	24.31	25.53	

Table 7A 3.2: Annual Revenues and Accounts Receivable

	Year	0	1	2	3	4	5
Annual Revenues			210.00	220.50	231.53	243.10	255.26
Accounts Receivable (AR)			42.0	44.1	46.3	48.6	0.0
Change in AR			-42.0	-2.1	-2.2	-2.3	48.6

Table 7A 3.3: Nominal Cash Flow Statement

	Year	0	1	2	3	4	5
Annual Revenues			210.00	220.50	231.53	243.10	255.26
Change in AR			-42.0	-2.1	-2.2	-2.3	48.6
Net Cash Flow			168.0	218.4	229.3	240.8	303.9
PV 15.50 %		593.30					

Table 7A 3.4: Sensitivity Analysis of the Quantity of Output on the PV of the Net Cash Flow

		PV
Quantity of Output	10	593.3
	11	652.6
	12	712.0
	13	771.3
	14	830.6
	15	890.0

In other words, it shows the relationship between the quantity of output and the PV of the net cash flow, with different values for the quantity of output.

At an output of 10 units, the PV of the net cash flow is USD 593.3. If the output were to increase from 10 units to 15 units, the PV would increase from USD 593.3 to USD 890. Based on this one-way Table, we can analyze the impact of changes in the units of the output on the PV of the net cash flow.

Impact of Changes in the Initial Output Price on the PV of the Net Cash Flow

Table 7A 3.5 shows the sensitivity analysis of the initial output price in Year 0 on the PV of the net cash flow. In other words, it shows the relationship between the initial output price and the PV of the net cash flow, with different values for the initial output price.

At an initial output price of USD 20, the PV of the net cash flow is INR 593.3. If the initial output price in Year 0 is INR 16 rather than USD 20, then the PV of the net cash flow would be INR 474.6. Based on this one-way Table, we can analyze the impact of initial output price in Year 0 on the PV of the net cash flow.

Table 7A 3.5: Sensitivity Analysis of the Initial Output Price on the PV of the Net Cash Flow

		PV
Initial Output Price	16	474.6
Year 0	17	504.3
	18	534.0
	19	563.6
	20	593.3
	21	623.0

Impact of Changes in the Accounts Receivable on the PV of the Net Cash Flow

Table 7A 3.6 shows the sensitivity analysis of the accounts receivable, as a percentage of the annual revenues, on the PV of the net cash flow.

In the Table of parameters, we assumed that the accounts receivable, as a percentage of the annual revenues, is 20 percent. However, it could turn out that the accounts receivable is a different percentage. Thus, if the accounts receivable is 30 percent rather than 20 percent, then the PV of the net cash flow would be INR 573 rather than INR 593.3.

Table 7A 3.6: Sensitivity Analysis of the Accounts Receivable on the PV of the Net Cash Flow

		PV
Accounts Receivable	20.0%	593.3
	22.0%	589.2
	24.0%	585.2
	26.0%	581.1
	28.0%	577.0
	30.0%	573.0

Impact of changes in the expected inflation rate on the PV of the net cash flow

Table 7A 3.7 shows the sensitivity analysis of the expected inflation rate on the PV of the net cash flow.

Table 7A 3.7: Sensitivity Analysis of the Expected Inflation Rate on the PV of the Net Cash Flow

		PV
Expected Inflation Rate	3.0%	595.0
	4.0%	594.1
	5.0%	593.3
	6.0%	592.5
	7.0%	591.7
	8.0%	590.9

Changes in the expected inflation rate have only small impacts on the PV of the net cash flow. For example, if the expected inflation rate is 8 percent rather than 5 percent, then the PV would be USD 590.9 rather than INR 593.3.

Two-way Table

In addition to the one-way Tables, we can also construct two way tables. We illustrate with one example, where we show the impact of changes in the quantity of output and the initial price in Year 0 on the PV of the net cash flow.

Table 8 shows the relationship between the quantity of output and the initial output price on the PV of the net cash flow. The entries in the matrix in Table 8 show the PV of the net cash flow for different combinations of values for the quantity of output and the initial output price. For example, if the quantity of output is 12 units and the initial output price is INR 18, then the PV of the net cash flow is INR 640.8.

How do we interpret the rows and columns in Table 7A 3.8? A row in Table 7A 3.8 shows the relationship between the initial output price in Year 0 and the PV of the net cash flow, for a given value of the quantity of output; and a column in Table 7A 3.8 shows the relationship between the quantity of output and the PV of the net cash flow, for a given initial output price in Year 0.

Importance of the Key Variables

Based on the results of the sensitivity analysis with all of the key parameters, we can identify and rank the set of key variables that will have the most impact on the NPV of the project. The relative importance of a variable depends on how much the NPV of the project changes due to a unit change in the key variable. Alternatively, we can calculate the percentage change in the NPV of the project due to a one percentage change in the value of the key variable. In addition, the selection of the important key variables will also depend on the experience, knowledge and judgment of the analyst, based on analysis from other comparable projects.

Table 7A 3.8: Sensitivity Analysis of the Quantity of Output and the Initial Price in Year 0 on the PV of the Net Cash Flow

	PV		Initial	Output	Price		
	593.30	16.0	17.0	18.0	19.0	20.0	21.0
	10.0	474.6	504.3	534.0	563.6	593.3	623.0
Quantity of Output	11.0	522.1	554.7	587.4	620.0	652.6	685.3
	12.0	569.6	605.2	640.8	676.4	712.0	747.6
	13.0	617.0	655.6	694.2	732.7	771.3	809.9
	14.0	664.5	706.0	747.6	789.1	830.6	872.2
	15.0	712.0	756.5	801.0	845.5	890.0	934.5

Sensitivity is a powerful tool for gaining insight into the impacts of key variables on the desired outcomes of a project. However, as we discuss below, there are several shortcomings with the sensitivity analysis.

The first shortcoming relates to the number of variables that sensitivity analysis can handle. With a one-way sensitivity analysis, we examine the impact of a single variable on the NPV of the project, holding constant the values of all the other key variables. With a two-way Table, we can analyze the impact of two variables on the NPV of the project, holding constant the values of all the other key variables. For more than two variables, sensitivity analysis becomes cumbersome to conduct, and difficult to visualize and interpret. In any project, more than two variables will be changing simultaneously, and as part of the risk analysis, we must be able to analyze the impact of simultaneous changes in several variables on the NPV of a project.

The second shortcoming of sensitivity analysis concerns correlations that may exist among the variables. In sensitivity analysis, we assume that the different variables are independent and we are unable to model the important correlations that may exist among the key variables. For example, there may be a negative relationship between the price of the output and the quantity of the output. With an increase in the price, the quantity demanded may decrease. In sensitivity analysis, we cannot model this negative correlation between the price and quantity demanded.

The third shortcoming of sensitivity analysis is the absence of probability distributions for the key variables. In the sensitivity analysis, we did not specify the likelihood of the values that we used in the ranges for the various key variables. This deficiency could be solved by assigning discrete probabilities to the values that we use in the one-way and two-way Tables. For example, for each of the four variables in the numerical example, we could assign discrete probabilities distributions for the range of values. However, with multiple variables, it would be quite tedious to implement, and furthermore, the interpretation of the results would also be problematic.

As we shall see below, the use of Monte Carlo Simulation (MCS) is the natural way to overcome the shortcomings of the sensitivity analysis. Before discussing MCS, we briefly discuss an intermediate method, which is scenario analysis.

Scenario Analysis

Scenario analysis is a partial remedy for the shortcomings of sensitivity analysis. Based on the set of key variables that have been identified through the sensitivity analysis, we describe three scenarios: best case (or optimistic case), expected case, and worst case (pessimistic case). Each scenario is based on a combination of possible values from the set of key variables. The analyst is not restricted to three scenarios, and could specify five or more scenarios. How many variables should we use in the specification of the scenarios? Four or five variables should be sufficient for practical purposes. With more variables, the construction and interpretation of the scenarios will be difficult.

How do we use the results of the scenario analysis? Under two extreme cases, we may decide as follows. If the NPV of the project is negative in the best case scenario, then it is reasonable to reject the project. Alternatively, if the NPV of the project is positive in the worst

case scenario, then we should accept the project. In practice, the results may not be so clear cut.

Scenario analysis also suffers from the other shortcomings that we had identified previously in sensitivity analysis. We are unable to assess the likelihood of the different scenarios because the scenario analysis does not specify the probabilities for the values of the different variables that form the basis for the scenarios. Furthermore, we cannot specify the correlations that may exist among the variables.

Monte Carlo Simulation

Of the three methods mentioned above, Monte Carlo Simulation (MCS) is the most complicated method for risk analysis. MCS is a natural extension of sensitivity analysis and overcomes the two major shortcomings of sensitivity analysis. As a result, it also increases the level of complexity in the analysis. However, with the development of easy-to-use software, it is relatively simple to conduct sophisticated Monte Carlo Simulations for project appraisal.

With MCS, we can specify probability distributions for the key risk variables, specify correlations that exist among the risk variables, and can model a reasonably large number of variables in a sensible manner. By specifying the probability distributions for the variables, we obtain the probability distributions for any desired outcomes, such as the NPV of the project from different points of view.

In conducting a MCS, we undertake the following steps.

1. Mathematical model: project appraisal spreadsheet.
2. Identify variables that are sensitive and uncertain.
3. Define uncertainty.
   a. Specify probability distributions.
4. Identify and define correlated variables.
   a. Positive or negative correlation.
   b. Strength of correlation.
5. Run the simulation model.
6. Analysis of results.
   a. Summary statistics.
   b. Probability distributions of desired outcomes.

Next, we briefly comment on each of the steps for the MCS. In the first step we construct the mathematical model for the project appraisal. As mentioned earlier, we have to ensure that the desired outcomes, such as the NPV of the project from different points of view, are properly linked via formulas to all of the previous Tables and to the key variables in the table of parameters. Without such proper linkages, we will not be able to conduct sensitivity analysis and the MCS.

In the second step, we conduct sensitivity analysis with one-way and two-way Tables to identify the key risk variables. From a practical point of view, six to eight risk variables would be a reasonable number. If the project is particularly complex, then a larger number of risk variables may be justified. However, a complicated analysis with a lot of risk variables may not necessarily lead to greater insight about the risk of the project.

In the third step, we specify the probability distributions for the risk variables. Commonly used distributions are: the uniform, triangular

and normal. If there is historical information or data on the risk variables, then we can use the historical information to guide us in the specification of the probability distributions. If there is no historical data, then we may have to rely on the opinions of experts or practitioners who may have good judgment on the likely range for the future movement of the values of the risk variables. Also, we may look for secondary data from the published literature and data for variables from other comparable and similar projects.

In the fourth step, we specify the direction (positive or negative) and strength of the correlations that may exist among the risk variables.

In the fifth step, we run the simulation model, and obtain the simulation results. The simulation results consist of summary statistics and probability distributions for all the variables and outcomes.

Interpretation of the Simulation Results

The most useful graphs are the cumulative probability distribution graphs for the NPV from different points of view. From the cumulative probability graph, the decision maker can easily determine the probability that the NPV of the project is positive.

For more details on the probability and statistical concepts that are relevant for risk analysis, please see the section on the foundations of risk analysis.

Part 8: Risk Management

Next, we discuss risk management. In risk management, we examine different ways to structure the internal and external relationships in a project. We can use contracts and other arrangements to improve the incentives that the different stakeholders face.

Before discussing risk management, we briefly describe the sources of risk in a project.

Sources of Risk in a Project

What are the sources of risk in a project? The risks that affect a project can be external (or exogenous) or internal (endogenous). First, we consider different types of external risks: market risk for the product, financial and foreign exchange risk, government policy, natural resources and natural disasters. Second, we consider internal risks, such as relationships between prices and quantities, real options in project design, incentive relationships and endogenous behavioral relationships.

Market Risk for the Product

One of the main risks is the demand for the output of the project. A good marketing analysis can provide an assessment of the market risk for the product. In addition to the demand for the project, there is also the risk in the output price, and in the prices and quantities of the inputs and raw materials.

Foreign Exchange Risk

If there are cash flow items that are in foreign currencies, such as imported inputs or revenues from exports, then fluctuations in the foreign exchange rate will be a risk factor for the project.

Government Policy and Politics

Changes in government policy, such as tax policy, licensing and regulations, can affect financial and economic viability of the project.

Natural Resources

In natural resource projects, the quantity of ore in the ground may be a risk factor.

Natural Disasters

Natural disasters may be a risk for some projects. It is difficult to plan for the impact of natural disasters.

Internal Risks to the Project

In addition to the external risks that we have discussed, there are internal risks to the project.

Risk of the Equity Holder

Now, we examine who bears the risk in a project. We write the expression for the return to equity as follows.

$$\text{Return to equity} = e \times E = p \times Q - m \times M - w \times L - d \times K - i \times D - T \qquad (1)$$

where,
e is the return to equity, E is the equity investment,
p is the price, Q is the quantity,
m is the unit price of materials, M is the units of materials,
w is the unit wage rate, L is the units of labor,
d is the depreciation (as a percentage of the investment), K is the investment,
i is the interest rate, D is the value of debt, and
T is the taxes.

The return to equity equals the revenues less the costs, which consists of the input costs, labor costs, depreciation, interest payments and taxes.

We can rewrite equation 1 to obtain the expression for the net value added.

$$\text{Net Value Added} = e \times E + i \times D + T + w \times L = p \times Q - m \times M - d \times K \quad (2)$$

The Left Hand Side (LHS) of equation 2 is the Net Value Added, which consists of the payments to the various stakeholders in the project, namely the equity holder, the debt holder, the government and the workers. The Right Hand Side (RHS) of equation 2 consists of the purchasers of the outputs and the suppliers of the inputs. Since the risk of the receipts to the stakeholders depends on the risks faced by the buyers and suppliers, the equity holders may wish to share the risk with them.

The risks that affect a project can be external (or exogenous) or internal (endogenous). First, we consider different types of external risks: market risk for the product, financial and foreign exchange risk, government policy, natural resources and natural disasters. Second, we consider internal risks, such as relationships between prices and quantities, real options in project design, incentive relationships and endogenous behavioral relationships.

How are the costs of risks reduced? Some risks can be virtually eliminated by spreading the burden across many persons. Other risks cannot be spread; it can only be shifted or reallocated.

Different players in the market place have different preferences, willingness and capacity to bear risk. The cost of risk is lower for those with greater capacity and willingness to bear risk, and thus there are gains to be obtained from trading in the tradeoffs between risk and risk-return.

Debt Financing and Debt Service Capacity Ratios

Typically, projects are financed with debt and equity. A viable project must generate sufficient cash flows to repay the principal and interest on a loan, and provide a positive equity return to the equity holder. The debt holder has the first claim on the cash flow, and the equity holder is the residual claimant. For example, if the cash flow is just sufficient to pay the debt holder, then the equity holder may receive nothing. Since the risk of the cash flow to the equity holder is higher than the risk of the cash flow to the debt holder, the required equity return is higher than the cost of debt charged by the debt holder.

The debt can be made more secure with guarantees, collaterals and specified returns. Equity holders have the incentive to increase low-cost debt financing to increase the returns to.

The debt holder would like to ensure that the debt is repaid with a reasonable likelihood. The Debt Service Capacity Ratio (DSCR) is a common criterion for evaluating the financial viability of a project from the perspective of the debt holder. The DSCR tells the financier (or banker) whether there is enough cash from the project over the long run to justify bridge financing when some years have inadequate cash flows to service the debt.

Annual Debt Service Capacity Ratio (ADSCR)

The Annual Debt Service Capacity Ratio (ADSCR) is the ratio of the annual free cash flow to the annual debt repayment.

Debt Service Capacity Ratio (DSCR)

The Debt Service Capacity Ratio (DSCR) is the ratio of the present value of the free cash flow, discounted at the loan interest rate, to the present value of the loan repayment, discounted at the loan interest rate, from the current period till the end period of the loan repayment.

Numerical Example

Consider a project that requires INR two million for investment. The proposed loan is for INR one million and the remaining INR one million is financed with equity contribution. The required rate of return for equity is
20 percent; the cost of the loan is 15 percent, and the loan is repayable in 5 equal installments.

Using the PMT function in EXCEL, we calculate that the annual equal payment for the loan is INR 298.3 thousand. Next, we calculate the ADSCR, which is simply the ratio of the annual net cash flow to the debt repayment. Since the loan payment is constant, the value of the ADSCR depends on the value of the annual cash flow, and it is highest in Year 4, when the cash flow is INR 440 thousand. This project is not attractive to the financiers because the ADSCRs are low. It means that the net cash flow may not be enough to meet the debt service obligation and to obtain the required rate of return on equity.

How can we improve the annual debt service capacity ratios? There are three possibilities:

1. Decrease the interest rate on the loan;
2. Decrease the amount of borrowing; and
3. Increase the duration of the loan repayment.

Table 8.1: Annual Debt Service Capacity Ratio (ADSCR)

Year	0	1	2	3	4	5	6	7	8	9	10
Net Cash Flow ('000)	-2,000	320	320	360	440	380	100	200	480	540	640
Debt Repayment ('000)		298.3	298.3	298.3	298.3	298.3					
ADSCR		1.073	1.073	1.207	1.475	1.274					

Table 8.2: Annual Debt Service Capacity Ratio (ADSCR) with Lower Interest Rate

Year	0	1	2	3	4	5	6	7	8	9	10
Net Cash Flow ('000)	-2,000	320	320	360	440	380	100	200	480	540	640
Debt Repayment ('000)		206.0	206.0	206.0	206.0	206.0					
ADSCR		1.553	1.553	1.747	2.136	1.844					

Table 8.3: Annual Debt Service Capacity Ratio (ADSCR) with Lower Amount of Loan

Year	0	1	2	3	4	5	6	7	8	9	10
Net Cash Flow ('000)	-2,000	320	320	360	440	380	100	200	480	540	640
Debt Repayment ('000)		179.0	179.0	179.0	179.0	179.0					
ADSCR		1.788	1.788	2.011	2.458	2.123					

Decreasing the Interest Rate on the Loan

One way to improve the ADSCR is to lower the interest rate on the loan. Suppose the interest rate is 1 percent rather than 15 percent. Then as shown below, the ADSCR is much higher.

With a lower interest rate, the ADSCR looks much better but it may not be possible to obtain a lower interest rate, except through guarantees or subsidies, such as IDA financing.

Decrease the Amount of Borrowing

Again, we see that the ADSCR has improved.

Another way to improve the ADSCR is to lower the amount of loan. Suppose the amount of the loan is lowered from INR one million to INR 600,000 at 15 percent. The new ADSCR is shown in the table below. Since the proportion of borrowing in the total investment decreases, the amount of the annual repayment of the loan also becomes smaller. Hence the ability to service the debt becomes more certain.

Increase the Duration of the Loan Repayment

A third way to improve the ADSCR is to increase the duration of the loan repayment from five years to 10 years. Increasing the duration of the debt repayment improves the ADSCR because the same amount of loan is repaid over more years. However, the lower ADSCRs in Years 6 and 7 due to the low cash flow in those years mean that the project is unable to meet the loan obligations in those years.

The project may face difficulties if the net cash flows are insufficient to serve the debt in some years. Would it be viable to obtain bridge-financing to meet the existing debt payments in some years?

To find out if the bridge financing is worth undertaking, we need to look at the cash flows and debt repayments over the remaining period of the loan.

Table 8.4: Annual Debt Service Capacity Ratio (ADSCR) with Longer Duration for Loan Repayment

Year	0	1	2	3	4	5	6	7	8	9	10
Net Cash Flow ('000)	-2,000	320	320	360	440	380	100	200	480	540	640
Debt Repayment ('000)		199.3	199.3	199.3	199.3	199.3	199.3	199.3	199.3	199.3	199.3
ADSCR		1.606	1.606	1.807	2.208	1.907	0.502	1.004	2.409	2.710	3.212

Table 8.5: Debt Service Capacity Ratio (DSCR) to Determine Viability of Bridge Financing

Year	0	1	2	3	4	5	6	7	8	9	10
PV of NCF @ 15.0 %	1,784	1,732	1,672	1,563	1,357	1,181	1,258	1,247	953	557	
PV of CFD @ 15.0 %	1,000	951	894	829	754	668	569	455	324	173	
DSCR		1.784	1.822	1.870	1.885	1.800	1.768	2.211	2.740	2.944	3.212

Bridge Financing

The DSCR is the appropriate criterion for determining the viability of bridge financing. Although the annual debt service capacity ratios in Years 6 and 7 are very low, the ability of the project to generate cash in subsequent years should be enough to obtain the bridge-financing for the two critical years.

Risk Spreading and Pooling

The most fundamental mechanism for reducing (or even eliminating risk) is risk spreading or pooling. As long as the variation in a particular return is unsystematic or unrelated to the other returns, then the variation can be reduced in line with the number of people sharing the return. By spreading the risk across a pool of persons (each owning a small share of the risk), the variability can be reduced to zero if the pool is large enough.

To understand the idea of risk spreading, we discuss some basic variance relationships. Let X and Y be two random variables, and let a and b be constants.

Var(X) is the variance of X, Var(Y) is the variance of Y and Cov(X,Y) is the covariance of X and Y.

It is easy to show that the following variance relationships hold.

$$Var(aX) = a^2 \times Var(X) = a^2 \times (\sigma_X)^2 \quad (1)$$

$$Var(aX + bY) = a^2 \times Var(X) + b^2 \times Var(Y) + 2ab \times Cov(X,Y)$$
$$= a^2 \times (\sigma_X)^2 + b^2 \times (\sigma_Y)^2 + 2ab \times Cov(X,Y) \quad (2)$$

The first relationship states that the variance of constant times a random variable X equals the square of the constant times the variance of X.

The second relationship applies to the sum of two random variables. Note the presence of the third term, which includes the covariance between X and Y.

If X and Y are independent random variables, then it means that they are unrelated and the covariance between them is zero. In this special case, we can simplify equation 2 as follows.

$$Var(aX + bY) = a^2 \times Var(X) + b^2 \times Var(Y)$$
$$= a^2 \times (\sigma_X)^2 + b^2 \times (\sigma_Y)^2 \quad (3)$$

Now let R be the return on a new investment project and let Var(R) be the variance of R. Suppose there are N investors and the investment project is equally divided among the N investors. Then the variance for an individual investor is just one nth of the variance of R.

$$\text{Variance for individual investor} = Var(R/N) \quad (4.1)$$

The total variance for all of the investors is as follows.

$$\text{Total variance for all investors} = N \times Var(R/N) \quad (4.2)$$

We can rewrite equation 4.1 as follows.

$$\text{Total variance for all investors} = N \times Var(R/N) = N \times (1N^2) \times Var(R) = Var(R)/N \quad (4.3)$$

Thus, we see that if the investment project is shared or owned by N investors, then the total variance for all the investors equals the variance of the project divided by N. As N gets large, the total variance tends towards zero. However, the expected total return remains the same.

Equation 6 is the basis for risk spreading or pooling. The total variance of the unsystematic risk declines toward zero as the risk is spread among many investors. Thus investors can spread (or pool) risks of investments across many different investments to reduce the unsystematic risk that is inherent in each investment.

We illustrate these ideas with a simple numerical example. Assume there are 100 companies in the oil exploration business. The probability of finding oil is 50 percent.

Box 8.1

If a company finds oil, the profit is INR 1.40 million and the rate of return is 140 percent. On the other hand, if the company does not find oil, then the
profit is -INR 1.0 million and the rate of return is
-100 percent.

The expected return E(R) is 20 percent and the standard deviation is 120 percent.

Expected return = E(R) = 50%×140% + 50%×-100%
= **20.0%** (5.1)

$Var(R) = (1.4 - 0.20)^2 \times 0.50 + (-1.0 - 0.20)^2 \times 0.50$
= **1.440** (5.2)

$Std(R) = \sqrt{((1.4 - 0.20)^2 \times 0.50 + (-1.0 - 0.20)^2 \times 0.50)}$
= **1.200** (5.3)

If a single investor puts all her money in the shares of one company, then the risk would be very high. Alternatively, the single investor could construct a portfolio that consists of one hundredth of the shares in each of the 100 companies. The return and risk of this portfolio would be as follows.

$E(R) = 20\%$ (6.1)

$Var(R) = (\sigma_R)^2 = 1.44/100 = 0.0144$ (6.2)

$Std(R) = \sigma_R = 0.12$ or 12% (6.3)

With the portfolio, the expected return for the investor remains the same as before, however the standard deviation has been reduced from 120 percent to 12 percent.

If 100 investors were to buy one hundredth of the equity in the oil exploration project, then the expected return and risk would be the same as that for the portfolio.

Systematic Risk

Next, we explore the notion of systematic risk and the relationship of the new project investment to the existing portfolio of investments. When a new investment is undertaken, we need to distinguish between the risk or variability in the return or NPV of the new project and the impact that the project has on the variability of the returns of the entire portfolio of investments of the investors in the project and the economy.

Systematic risk refers to the covariance (or correlation) between the returns on the new project and the returns on the existing portfolio of investments of private investors or all investments in the economy.

Investors demand a price or risk premium to bear risk or variability in return. To reduce the

Table 8.6: Statistics for Oil Exploration for a Single Company

Outcomes	Probability	Profit (INR million)	Rate of Return (R)
a. Find Oil	0.50	1.40	140%
b. Do not find Oil	0.50	-1.0	-100%

variability in returns of individual investors, it is common practice to spread the ownership among many owners. This reduces the variability in returns from the new project but necessarily in aggregate when the variability is viewed in conjunction with existing investments. It is possible to show these concepts with basic variance relationships.

Let ρ_{XY} be the correlation coefficient between X and Y. Then the relationship between the correlation coefficient and the covariance is as follows.

$$\rho_{XY} = Cov(X,Y)/(\sigma_X \times \sigma_Y) \quad (7.1)$$

Solving for the covariance, we obtain,

$$Cov(X,Y) = \rho_{XY} \times \sigma_X \times \sigma_Y \quad (7.2)$$

From above, we know that,

$$Var(aX + bY) = a^2 \times (\sigma_X)^2 + b^2 \times (\sigma_Y)^2 + 2ab \times Cov(X,Y) \quad (8.1)$$

Substituting equation 7.2 into equation 8, we obtain,

$$Var(aX + bY) = a^2 \times (\sigma_X)^2 + b^2 \times (\sigma_Y)^2 + 2ab \times \rho_{XY} \times \sigma_X \times \sigma_Y \quad (8.2)$$

Regression Analysis

From the standard OLS (Ordinary Least Squares) regression analysis, we obtain the following results. Assume that there is a linear relationship between Y and X, where ε is a random variable with a normal distribution and zero mean.

$$Y = \alpha + \beta \times X + \varepsilon \quad (9)$$

The intercept is α and the slope coefficient is β. We can show that the slope coefficient equals the ratio of the covariance of X and Y, and the variance of X.

$$\beta = Cov(X,Y)/Var(X) \quad (10)$$

Substituting the expression for the covariance, we obtain the following equation for the slope coefficient.

$$\beta = Cov(X,Y)/Var(X) = \rho_{XY} \times (\sigma_X) \times (\sigma_Y)/(\sigma_X)^2 = \rho_{XY} \times (\sigma_Y/\sigma_X) \quad (11)$$

Incremental Systematic Portfolio Risk

To assess the impact on the risk of an investor, it is necessary to check how the new investment covaries with the existing portfolio and estimate the incremental impact on the portfolio risk of the investor. Let R be the return on the new investment project and P is the return on the existing portfolio. Then,

$$Var(R + P) = (\sigma_R)^2 + (\sigma_P)^2 + 2\rho_{RP} \times \sigma_R \times \sigma_P \quad (12.1)$$

Substituting the expression for the slope coefficient, we obtain,

$$Var(R + P) = (\sigma_R)^2 + (\sigma_P)^2 + 2\beta \times (\sigma_P)^2 \quad (12.2)$$

The variance of the new project $(\sigma_R)^2$, is the variance resulting in the diversifiable risk that can be reduced through risk pooling or spreading. The covariance term gives the incremental nondiversifiable or systematic risk for the portfolio of the investor. The systematic risk is a real unavoidable cost to investors. The systematic risk is not reduced if the government rather than the private sector undertakes the project.

Risk-sharing can change the endogenous incentives because different stakeholders have differing ability to influence project outcomes. We can use contracts to reduce the risk profile of the project cash flow. There are two possibilities. First, we can structure risk-sharing contracts that reduce the investors' risk by increasing the correlation between sales revenues and some cost items.

Mechanisms for Reducing the Costs of Risk

There are four main mechanisms for reducing the costs of risk. First, we can use the capital, financial and futures markets. Second, we can use contracts to reallocate or share the cost of risk reduction. Third, there are real options. And fourth, we can use project finance.

Capital, Financial and Futures Markets

Typically, investments are financed with a combination of debt and equity. The financing for a project can be raised in the financial markets. The financial structure, that is, the mix of debt and equity, results in different payoff structures for the debt and equity holders.

Contracting

To reduce the costs of risk, we can use contracts to reallocate or share risks. Contracts can change the internal relationships to deal with exogenous market variability, such as foreign exchange risk. For example, contracts may use product price formulas.

We can also use contracts to limit exogenous market variability in prices and quantities of raw materials.

Contracts are also relevant for changing the internal relationships and thus change the endogenous incentives. Examples include profit sharing, stock options and other flexible wage agreements. In addition, there can be profit participation by the construction contractor and operator.

Real Options

With real options, we can design flexibility into the project. The real options allow us to respond to changes in information or market conditions. There is a cost to the added flexibility and thus we have to compare the benefits of the flexibility with the cost of increasing the flexibility in the project.

Project Finance

Project finance consists of complex contractual arrangements to deal with risk in large investments. In nonrecourse project finance, the stakeholders in the project only have claims to the cash flow that is generated by the project. Thus, it is important to structure the contracts in such a way that all the claimants to the cash flow satisfy their required rates of return.

Capital Asset Pricing Model (CAPM)

If investors can establish well-diversified portfolios and have a risk-free investment available (such as a government bond), then

they can invest in a mix of the risk-free investment and their investment portfolio.

If individual investors have no special information, the portfolio of the individual investor should be similar to the market portfolio. Hence, investors can choose an investment mix of the risk-free and market portfolio which plots out the "market line" running from the risk-free return through the market return at the market standard deviation. Therefore no investment should pay a return that falls below this line given the variability in its return.

Let r_m be the return on the market portfolio and r_f be the risk-free rate. The market pays a risk premium of $(r_m - r_f)$, which is the difference between the return on the market and the risk-free rate. The risk premium paid on any particular investment should be proportional to its contribution to the market portfolio risk premium. This relationship to the market portfolio of the returns on any investment (r_j) is measured by its "beta" (β_j). Hence the CAPM is expressed as:

$$r_j - r_f = \beta_j \times (r_m - r_f) \qquad (1)$$

Or the return on any investment should be the risk-free return plus its "beta" times the market risk premium. The beta β_j for any investment "j" can be found by regressing the returns for that type of investment on the market return. In the extreme case, the risk-free investment has a beta of zero, and as expected, the return on the investment equals the risk-free rate. On the other hand, if the investment has a beta of one, then the risk of the investment equals the risk of the market portfolio.

Another perspective can be gained from the following expression.

$$\beta_j = \rho_{j,market} \times (\sigma_j / \sigma_{market}) \qquad (2)$$

We can express the beta in terms of the correlation between the investment and the market portfolio $\rho_{j,market}$, the standard deviation of the investment σ_j and the standard deviation of the market σ_j. The beta rises with the degree of correlation of the return on investment "j" with the market and the variance in the return on the investment itself.

Risk Allocation: Sources of Contracting Risks

In developing countries, well-developed capital, financial and futures markets are not always available. Investors can use contracts to shift and share risks. Special contractual arrangements are often required to mitigate risks and make projects viable. We can view contracts from either the cost perspective or the efficiency perspective. The cost perspective is implicitly a zero-sum perspective. What one party gains, the other party loses. An efficiency perspective is explicitly a positive sum perspective. With the right contract, one party may be able to gain substantially without a corresponding cost to the other party.

Risk Shifting of Exogenously Generated Risks

First, investors have different risk preferences. And a less risk-averse investor may be willing to accept a lower return on a risky asset. Second, different stakeholders have different capacities to diversify. For example, foreign investors may have more opportunities to diversify their

investments in efficient capital markets. Third, there are differences in the outlooks, predictions and information about the future. Some investors may be more optimistic than others.

Contracts that Restructure Intra-project correlations

Risk-sharing can change the endogenous incentives because different stakeholders have differing ability to influence project outcomes. We can use contracts to reduce the risk profile of the project cash flow. There are two possibilities. First, we can structure risk-sharing contracts that reduce the investors' risk by increasing the correlation between sales revenues and some cost items. Examples include:

- Profit-sharing contracts with labor;
- Bonds with interest rates indexed to produce sales price;
- Debt financing in the same currency as the product sales; and
- Product price indexed to major raw materials price.

Second, we can use contracts that decrease the correlation between benefit items or alternatively between cost items.

The formal demonstration of these ideas is as follows. Earlier, we had presented the following equation for the variance of two random variables.

$$\mathrm{Var}(aX + bY) = a^2\times\mathrm{Var}(X) + b^2\times\mathrm{Var}(Y) + 2ab\times\mathrm{Cov}(X,Y)$$
$$= a^2\times(\sigma_X)^2 + b^2\times(\sigma_Y)^2 + 2ab\times\mathrm{Cov}(X,Y) \quad (3)$$

For our purposes, let X be the revenues R, let Y be the costs C, let a equal 1, and let b equal -1.

Then we can rewrite equation 1 as follows:

$$\mathrm{Var}(\text{Net profits}) = \mathrm{Var}(Y - C) = \mathrm{Var}(R) + \mathrm{Var}(C) - 2\times\mathrm{Cov}(R,C) \quad (4)$$

Any measure that increases the positive correlation between revenues and costs will increase the Cov(R, C), and, in turn, this reduces the variance of the net profit (provided of course that the measure does not increase the variance of a cost item by more than twice the change in the covariance.)

Profit-sharing Agreement with Labor

Assume that wages are the only cost. Without the agreement, the labor cost is C. Next, we examine the labor cost with agreement. Let g be the proportion of the costs that is still paid to workers as a fixed part of the wage, and let h be the labor's share of profit after wages have been paid.

$$\text{Thus, total cost} = g\times C + h\times(R - g\times C) \quad (5)$$

where, the first term is the fixed wage and the second term is the flexible wage.

$$\text{Net profit} = R - g\times C - h\times(R - g\times C)$$
$$= (1 - h)\times R - g\times(1 - h)\times C \quad (6)$$

The expression for the variance of the net profit is as follows:

$$\mathrm{Var}(\text{Net profit}) = (1 - h)^2\times\mathrm{Var}(R) + g^2\times(1 - h)^2\times\mathrm{Var}(C) + \mathrm{Var}(R) + 2\times g\times(1 - h)\times\mathrm{Cov}(R,C) \quad (7)$$

And if $0 < g < 1$ and $0 < h < 1$, then the variance of net profit is lower than it is without the wage agreement.

Real Options

Project design decisions that we make today affect the flexibility in responding to uncertain opportunities or constraints in the future. We discuss several examples. First, we could buy a larger land area than currently needed. This would give us the opportunity (or "real option" as compared to a financial option) to expand the future production of output in the event that demand is stronger than expected. Second, we could buy a more expensive machinery; however, the higher cost of the equipment is offset by the greater benefits that we obtain from the flexibility in changing product lines or using different types of materials. Thirdly, we may forego the tax incentives to enter an export processing zone because the location in the export processing zone does not allow us to sell in the domestic market when there is a downturn in the export market. Fourthly, we may prefer to have a lower target debt-equity ratio to avoid debt restructuring costs if there are declines in the future cash flows.

Part 9: Economic Externalities

Introduction

In an economy where there are no taxes, subsidies, or market imperfections such as monopoly, external costs/benefits (pollution, congestion, common property), at the margin there is no divergence between the value of a good or service as manifested by its demand price and the cost of production as represented by the supply price. In this kind of ideal world, the financial and economic prices of outputs and inputs are the same and there is no difference between the financial appraisal of an investment and its economic evaluation. These distortions and imperfections, however, exist in real markets and can be the source of external welfare effects that should be taken into account while estimating the economic impacts of production or use of a product by the project.

Economic externalities are said to exist when the economic value of a product is different from its financial price. For example, to the extent that the economic benefit (value) to the society of the incremental output of a project is greater than the financial price received by the project owners, a positive externality is created. When building up the economic benefits from the financial receipts, all externalities should be added to the financial receipts. Similarly, if the economic costs of the resources required by a project exceed their financial cost, a negative externality is created that should be added to the financial expenditures incurred by the project. Annex IV presents an example of the different types of externalities that one may usually come across while appraising a project and also demonstrates how they are accounted for in moving from the financial to the economic analysis.

In some circumstances, externalities could also arise due to the impact of the project on other industries, particularly industries producing close complementary and substitute goods, or externality might exist in industries producing inputs to the intermediate goods used by the project. If industries producing complementary or substitute goods experience changes in demand or supply, which in turn lead to a price change or a change in government revenues, an externality is created. One should carefully analyze the situation to determine whether the impact on substitutes and complements is expected to be small and could be ignored for practical purposes, or is large and should be included in the analysis.[21] Similarly, if an externality exists in the market for one of the inputs of an intermediate goods required by a project and it is sufficiently large, it would be necessary to include it in the analysis. See Annexure 1, 2 and 3 for discussions on Economic factors that affect projects.

What is Economic Externality?

All the distortions and imperfections in the markets for both traded and nontraded goods or services may be included in the term "economic externality" defined in a broader sense. Economic externality arises because of a divergence between the marginal social value and the marginal social cost of activities whose demand or supply is affected by a project. While physical or technological externalities refer to effects like noise, pollution or congestion, the term "economic externality" would cover all potential sources of external welfare effects that have been described above. With this connotation, "economic externality" may be defined as follows.

[21] For a detailed analysis of incorporating the impacts of a project on complementary and substitute markets, see Harberger, A. and Jenkins, GP., "Manual for Cost Benefit Analysis of Investment Decisions," Unpublished, Chapter 11, Section 3 (HIID, Harvard University 2005).

An externality or external economy (diseconomy) is an occurrence or incident that confers benefits (damages) on some persons who are not fully consenting parties in reaching the decision that gives rise to the event in question.[22]

It may be noted that an economic externality arises when the persons affected were not fully consenting parties to the decision. For instance, in case of taxes and subsidies the affected individuals might have been a party to the process leading to the installation of the government (voting), but they are not a party to the institutional process through which these measures are approved. As a result, each time that a project causes a change in the level of a taxed activity that yields more or less tax revenues to the government, an externality arises.

There are several situations where an economic externality may arise. Some of the cases of externalities that are of relevance while appraising a project are described below.

Environmental Externalities

Environmental externality is generated when the external diseconomy arises as a result of the production process of a project. The different kinds of pollution created by industrial firms and infrastructure projects (power, transport) in the process of producing goods and services fall in this category. A lot of waste products or effluents are deposited in the atmosphere, waterways and the ground by some projects. This has a damaging effect on people and property that are not directly involved with the production or consumption of the output.

Whenever an investment has an adverse impact on the environment, there are two steps to incorporate this effect into project evaluation. First, the cost of measures necessary to reduce or eliminate the impact should be part of the project and the costs of those measures should be included both in the financial and economic analyses of the project.

Accounting for Environmental Externalities in Project Appraisal

Whenever an investment has an adverse impact on the environment, there are two steps to incorporate this effect into project evaluation. First, the cost of measures necessary to reduce or eliminate the impact should be part of the project and the costs of those measures should be included both in the financial and economic analyses of the project. These measures may include alterations in the existing plant or adding some new equipment. If the impact on the environment cannot be totally eliminated, as would generally be the case, then the damage caused by the residual impact should be estimated and added as a cost in the economic analysis of the project. This evaluation of the residual impact on the environment and consequently on the people may not be always straightforward and may often require special evaluation techniques.

Monopoly Externalities

Sometimes, there is only one producer of a good or service in the economy and he enjoys a monopoly in the market. The monopolist is in a position to set the price and then sell the output that is demanded by the consumers at that price. From an alternative perspective, the monopolist can restrict the output which will raise the price of the good/service in the market

[22] This definition is due to James E. Meade; "The Theory of Economic Externalities," Institut Universitaire de Hautes Etudes Internationales, Geneva (1973).

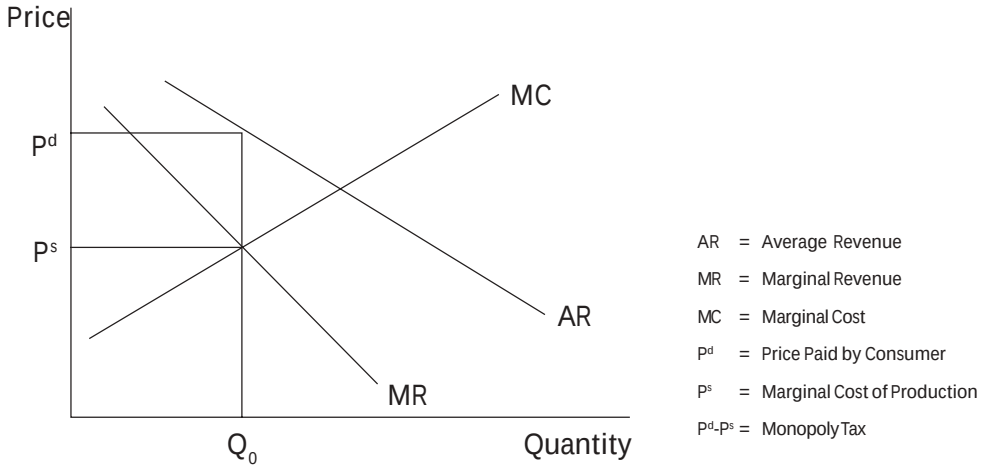
over and above its marginal cost of production.[23] Compared to the situation in a competitive market, the amount of the good/service transacted in the market is lower and the price is higher. As a result, consumers lose and the producer gains at the cost of consumers. The determination of price and quantity in a monopoly market is depicted in the Figure below.

A monopoly may arise due to a variety of reasons. There may be a single owner of a resource that is crucial to the production process; there may be some legal or institutional barriers to the entry of other producers; or there may exist a natural monopoly arising from economies of large scale production that leaves no scope for more than one producer.[24]

Whatever be the cause of the monopoly, the result of a monopolistic market is a divergence of selling price from the marginal cost. The way in which this leads to the rise of externalities may be seen from analyzing the situation in which the demand for the product of the monopolist increases over time. This may be due to a change in preference or simply an increase in population over time. The monopolist producer may react to this in one of the two ways: (i) Producing and selling the same quantity of product as before but at a higher price; or (ii) Increasing the output and selling a larger quantity at the same price.

In the first scenario, there is a redistribution of income from the previous consumers to the producer. With respect to the product that the previous purchasers continue to purchase but at a higher price, a larger sum of money is paid for the same quantity. Thus the monopolist producer gains at the cost of the previous consumers. This happens due to an increase in demand of the product by other consumers, a

Figure 9.1: Monopolistic Market



[23] This price difference is sometimes referred to as a monopoly tax. The consumers have to pay a higher price compared to the situation in a competitive market as if the monopolist is imposing a tax on them. As a consequence, the consumer surplus declines and the producer surplus is higher.

[24] The single ownership situation may arise in case of natural resources. The legal/institutional barriers often have their origin in some patent law. The natural monopoly occurs in case of large-scale utilities such as railways and telecommunications.

decision in which neither the previous consumers nor the producer played any part and to which the previous consumers were not a consenting party. This is an external economy to the monopolist and an equal offsetting external diseconomy to the previous consumers.[25] This transfer from the consumers to the producers is relevant for analyzing the distributional impact of the project.

In the second scenario, the monopolist producer sells more at the same price because of the new set of consumers. Thus the monopolist benefits without hurting any one else and because of the decision of the new buyers to which he was not a party.[26] For the sake of argument, if this producer is the only monopolist in the economy while there is perfect competition every where else including the labor market, there will be a divergence between social cost and social value in the monopolist's market but nowhere else. Any development that increases the sale of the monopolist's output will enhance his total real income without making any one else worse off.

Tax, Tariff, Subsidy Externalities

Taxes are imposed by the governments in order to raise revenues for the government and the public sector. The purpose of this revenue is to achieve some objective of public expenditure.[27] Taxes combined with subsidies may be viewed as instruments of redistribution of income in the society. Import duty and export taxes (subsidies) may serve the purpose of raising revenues and also for giving specific direction to the trade policy of the state. When a tax, a tariff or a subsidy is imposed on any good or service, there is a divergence between the marginal value and marginal cost of production.

Tax and Subsidy in the Market of Nontraded Goods

When a tax or tariff is imposed the value of the unit of the commodity to the consumer is given by the price of product inclusive of tax. The cost of production, on the other hand, is the price excluding the tax. A tax (t) or tariff will cause the marginal value to be higher than the marginal cost while a subsidy (k) will have an opposite impact.

Thus, the additional revenues to the government due to the purchase of that item represents the excess of benefit over cost. Also, the beneficiaries of the activities of the government that are financed by these tax revenues have a real income gain. By purchasing an additional unit of the taxed item, a consumer creates external economy that is to the benefit of some one else.

It may be pointed out that the decision maker in the case of imposing a tax or extending a subsidy is the government or the legislature. The people affected by this decision could be a party to electing the lawmakers but they cannot be said to be a fully consenting party to the decision making process for imposing specific taxes and subsidies.

[25] In this case the external effect takes the form of redistribution of income due to an increase in price of the product and this is sometimes referred to as "distributional externality."

[26] This is the case of a "real income externality" in which the benefit to the producer is not due to transfer from some one else in the economy.

[27] The purpose of raising revenues is to enable the government to perform functions that cannot be undertaken by the private sector due to "market failures." The government is also required to adopt appropriate fiscal and monetary policies for the stabilization of the economy. Also, expenditures in social sectors (healthcare, education) are necessary for reducing income disparities and promoting equity.

Figure 9.2: Relationship between Tax and Commodity Price and Quantity

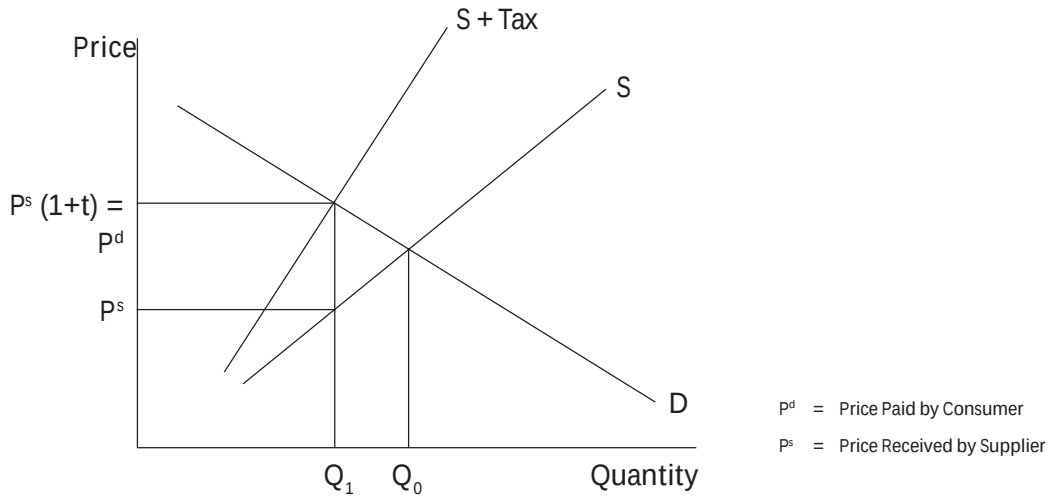
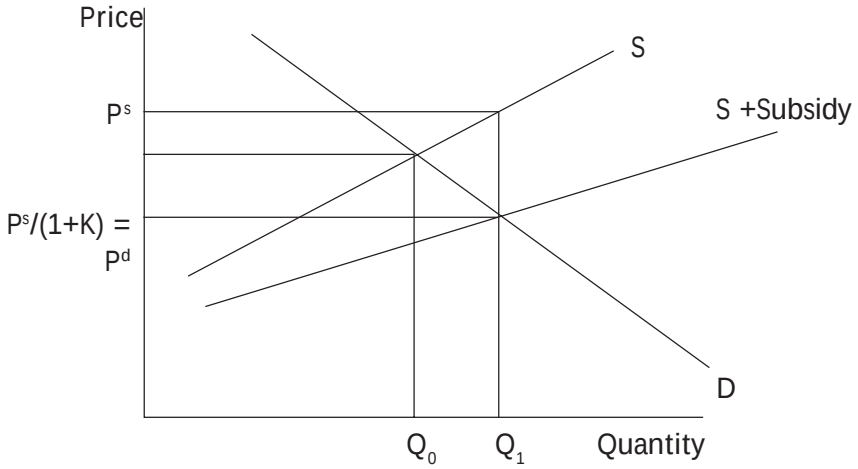


Figure 9.3: Relationship between Subsidy Commodity Price and Quantity



Import Duty and Export Tax in the Market of Traded Goods

When import duty is imposed on goods imported in the country, there is again a divergence between the marginal cost of the item and the marginal value to the consumers. The marginal cost to the economy is the international price P_w at which the item is imported while the marginal benefit is the tariff (t) inclusive price P_w (1+t) paid by the consumers. This is depicted in figure below. The additional revenue to the government represents the excess of benefit over cost.

When there are export taxes or export subsidies, a similar situation arises and there is a difference

Figure 9.4: Distortion Due to an Import Duty

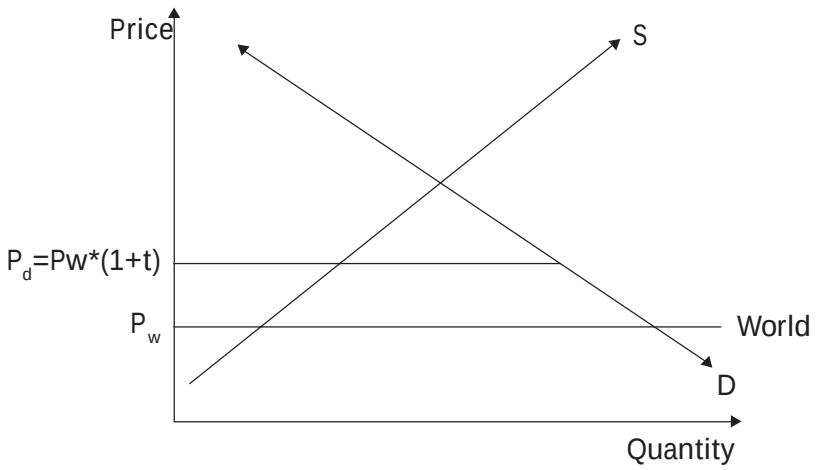
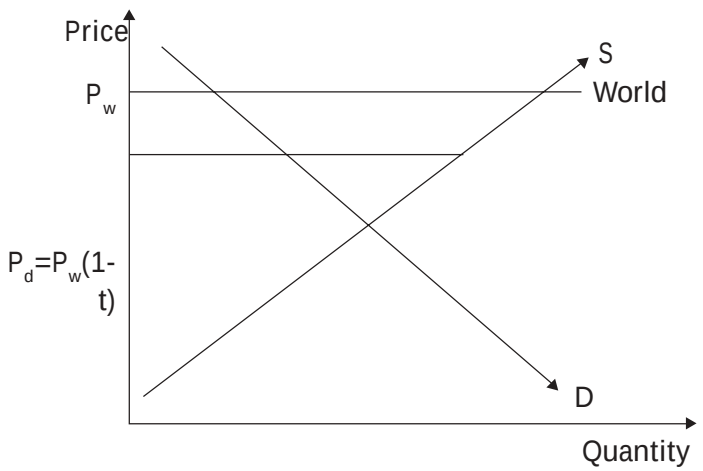


Figure 9.5: Distortion Caused by an Export Tax



between the economic benefit and the economic cost of the exported item. The economic cost is P_w while the economic benefit is P_w (1-t). The case of export tax is shown in Figure 9.5.

As a consequence of taxes, tariffs and subsidies economic externalities also arise in the markets of foreign exchange and labor. These two types of externalities are discussed in the following two sections.

Foreign Exchange Externality

The foreign exchange externality is meant to capture any indirect external welfare effects that result from a project's incremental use or production of foreign exchange. The source of this externality lies in the divergence that exists between the marginal value of a unit of foreign exchange and the marginal cost of earning that unit. This divergence is ultimately due to distortions in the markets underlying the demand and supply of foreign exchange.

The market of foreign exchange is a derivative of the markets for imports and exports. Behind the domestic demand for foreign currency is the demand for imports, which in turn depends upon the domestic demand and supply of importable goods. Thus the demand for imports is translated into the demand for foreign exchange by importers. Similarly, behind the domestic supply of foreign currency is the supply of exports which depends on the domestic supply and demand of exportable goods. Any distortions such as import duties, value added tax, export tax or subsidy or quantitative control in the markets of importable and exportable goods will distort the demand or supply of foreign currency.

Accounting for the Foreign Exchange Externality into Economic Analysis

If a project requires foreign exchange in order to purchase imported inputs, the increased demand would bid up the real price of foreign currency. This higher price would discourage other users of foreign currency on one hand and would stimulate some producers (exporters) to generate more of foreign exchange on the other. Just as in the case of taxes and subsidies on goods and services, the tax and tariff distortions create a wedge between the value of a unit of foreign exchange to the importers and exporters and the marginal cost or benefit of that unit. For importers, the value of a unit of foreign exchange will be different from the marginal cost to the country of earning that unit of foreign exchange. Again, for exporters the value of a unit of foreign exchange will differ from the total value of economic resources earned by the economy from the export.

When there are substantial import tariffs in the country, the economic price of a unit of foreign exchange would be higher than its market value. This difference accounts for the externality and is referred to as foreign exchange premium. This foreign exchange premium has to be added to the financial values to arrive at the economic values of traded inputs and outputs. The methodology for the estimation of this premium is presented in Annexure 1.

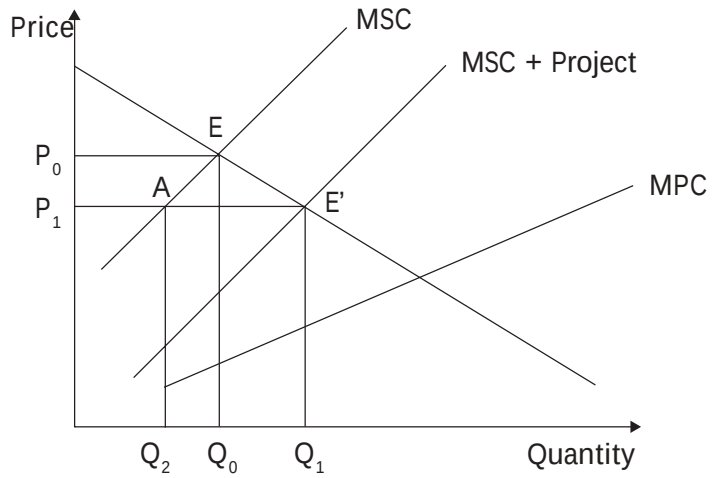
Economic Benefits Including Externalities

In order to estimate the economic benefit of a project, its overall impact on the economy is examined taking into consideration the externalities that are present. As outlined above, in the presence of the externality, the social demand and the social supply are different from the private demand and the private supply, respectively.

MPC = Marginal private cost
P_0 = Price before project
MSC = Marginal social cost
P_1 = Price after project

This is illustrated in Figure below. In the presence of an externality that creates a divergence between the social value and the marginal cost, it is the social cost or social benefit curve that has to be taken into account in estimating the benefit of the output of a project or the cost imposed by its use of an input. Before the project, the social equilibrium is at E with optimal quantity Q_0 and price P_0. With the project, the price is P_1 and quantity is Q_1. There is a higher quantity in the market at a lower price. More consumers can enjoy the product and therefore the benefit to consumers has increased by EE' Q_1 Q_0. On the other hand, at a lower price, other producers cut back their production to Q_2 and some resources (EA Q_2 Q_0)

Figure 9.6: Relationship Between Project Social Cost and Commodity Pricing and Quantity



are released to the economy that can be used for other purposes. Thus the total economic benefit of the project is the sum of additional benefit to consumers and the saving of resources to the economy due to the project, EA Q_2 Q_1 E'.

Economic Costs Including Externalities

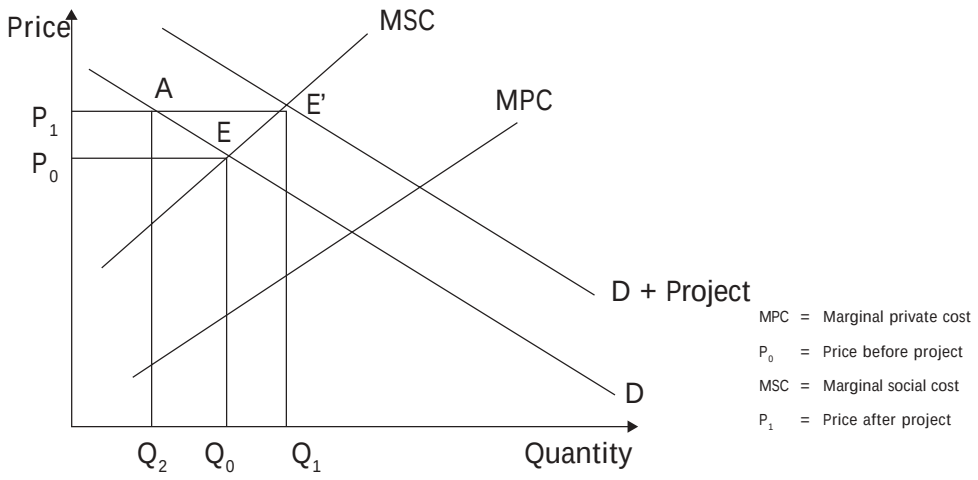
The estimation of economic costs due to use of an input by a project may be done in a way that is similar to estimating the benefits. The equilibrium in the market of the input in the presence of externality is E with an optimal quantity Q_0 and price P_0. When the project uses this input in its production process, the demand moves out and the new equilibrium is at E' with quantity Q_1 and price P_1. Some new producers begin additional supply of the input because of the higher price and the cost of these resources to the economy is EE' Q_1 Q_0. Also, because of an increase in price of the input, some other consumers are pushed out of the market and the benefit foregone is EA Q_2 Q_0. Thus, the total economic cost of project in the presence of an externality is the sum of these two costs and equals EA Q_2 Q_1 E'. This is illustrated in Figure 9.7.

Economic Externalities in the Capital Market and the Labor Market

The distortions in the capital market in the form of taxes and subsidies on return to savings (personal income taxes) and investment (property tax, corporate income tax) cause a divergence between the financial cost of capital (financial discount rate) and the Economic Opportunity Cost of Capital (EOCL or the economic discount rate) which is to be used for applying the investment criteria while conducting economic analysis of a project. The methodology for estimation of opportunity cost of capital is presented in Annexure B.

Similarly, there are distortions in the labor market (income taxes, minimum wages) that create a distortion between the financial wage and the economic wage. While the market wage rate is used in conducting financial analysis of a project, the economic cost of labor has to be used in economic analysis. The methodology for estimating the economic cost of labor (EOCL) is presented in Annexure 3.

Figure 9.7: Relationship Between Project Private Cost and Commodity Pricing and Quantity



Annexure 9A1:

Different Types of Externalities and Accounting for them in the Economic Analysis

The various externalities that one may often come across in appraising a project are described in table below (middle column). Also, the relationship between the financial analysis and the economic analysis is summarized in this table. Column 1 presents the itemized incremental expected cash flows from the perspective of all investors. The bottom line for the financial analysis is measured by the NPV of the incremental expected net cash flows to *total* capital discounted by the private discount rate, i.e., the weighted average cost of capital (WACC) for that project.

Column 2 lists the various adjustments and externalities that need to be made to the financial analysis in order to turn it into an economic analysis. The adjustments account for any change in consumers' surplus and/or economic rent.

Column 3 includes the estimates of incremental economic benefits and costs. There are two ways of achieving these estimates, namely: (a) Use Harberger's three principles or postulates of willingness to pay, supply price, and "a rupee is a rupee" to measure economic benefits and costs directly; or (b) Add the appropriate adjustment or externality to the corresponding financial cash flows to measure economic benefits and costs indirectly. The economic externality associated with each of the cash flow items is simply the difference between the economic price and market price of that item

For example, cash receipts and expenditures on materials, machinery and equipment in table below are divided into those arising from the sale and purchase of *tradable* and *nontradable* commodities. The sale and purchase of *tradable* commodities will generate tariff and tax externalities as well as a foreign exchange externality. The latter is due to distortions in the markets for the country's all *tradable* and *nontradable* commodities, not just in the market for the project's inputs and output that cause the economic opportunity cost of foreign exchange (economic exchange rate) to differ from the market exchange rate. The effect of adding the foreign exchange externality to the domestic value of the incremental foreign exchange generated by either a project's exports or its import substitution, as in approach (b) above, is equivalent to valuing the incremental foreign exchange by the economic exchange rate, as in approach (a). Similarly, the foreign exchange externality should be added to the domestic cost of foreign exchange required for tradable materials, machinery and equipment.

Using approach (a), the economic benefit of a project's *nontradable* output is measured by the economic value of any incremental industry output and consumption (based on willingness to pay) and/or by the economic value of any resources (based on their supply price) released by other firms in the industry that are forced to reduce their output or shut down in response to a project's increased output. Let us say that a project's output just creates incremental industry output and consumption. If the output is subject to a sales tax such that the price paid by consumers inclusive of the tax is higher than the price received by producers, then the

Table 9A 1.1: An Overview of Financial Cash Flows, Economic Externalities, and Economic Benefits/Costs

NPV of Incremental Private Sector Financial Cash Flows	NPV of Economic Externalities and Adjustments	NPV of Incremental Economic Benefits and Costs
1. Incremental Cash Receipts		*1. Incremental Economic Benefits*
a. Tradable Commodities (+)	a. Tariff and Tax Externalities (-); Foreign Exchange Externality (+)	a. Economic Value of Tradable Output (+)
b. Nontradable Commodities (+)	b. Additional Sales/Excise Tax Revenues (+); Changes in Consumers' Surplus and Economic Rent (+ or -)	b. Economic Value of Nontradable Output (+)
2. Incremental Cash Disbursements		*2. Incremental Economic Costs*
a. Materials, Machinery and Equipment (including On-site Infrastructure, but Excluding Construction Labor)		
i. Tradable (-)	a.i. Tax and Tariff Externalities (+); Foreign Exchange Externality (-)	a.i. Economic Cost of Tradable Materials and Equipment (-)
ii. Nontradable (-)	a.ii. Changes is Sales/Excise Tax Revenue (+ or -)	a.ii. Economic Cost of Non tradable Materials, Equipment (-)
b. Construction and Operating Labor (-)	b. Labor Externality (+) (including Economic Rent and Economic Benefits from Multiplier Effects)	b. Economic Opportunity Cost of Construction and Operating Labor (-)
c. Income Taxes (-)	c. Income Taxes (+)	0
d. Property and Municipal Taxes (-)	d. Property and Municipal Taxes (+)	0
e. Other Business Taxes (-)	e. Other Business Taxes (+)	0
f. Public Utilities and Services (-)	f. Adjustment for Nonefficient Pricing of Utilities and Services (+ or -)	f. Economic Cost of any Incremental Resources Used (-)
g.	g. Adjustment for Economic Cost of Off-Site Infrastructure (-)	g. Economic Cost of Off-Site Infrastructure (-)
h.	h. Externality from Foreign Financing (+ or -)	h. Externality from Foreign Financing (+ or -)
i.	i. Environmental Externality (+ or -)	i. Environmental Externality (+ or -)
j.	j. Basic Needs Externality (+)	j. Basic Needs Externality (+)
k.	k. Other Externalities (+ or -)	k. Other Externalities (+ or -)
NPV of Net Cash Flow to Total Capital Discounted at Private Discount Rate (PDR)	NPV of Economic Adjustment Discounted at the Economic Discount Rate	NPV of Net Economic Benefits Discounted at the Economic Discount Rate (EDR)

economic value of any incremental output (based on willingness to pay) will include the incremental sales tax revenue (i.e. approach (a)). The alternative approach (b) recognizes that the sales tax is a market distortion that creates a sales tax externality that should be added to the private sector cash receipts to measure a project's economic benefits.

The economic costs of the resources required by a project are measured by their economic opportunity cost since these scarce resources

would have been involved in alternative activities in the absence of a project. When the resources would otherwise have been employed, then their opportunity cost is measured by the willingness of other users to pay for their use in their forgone employment. When the resources have to be attracted to this industry from elsewhere in the economy, then their supply price becomes the economic opportunity cost. And, when resources are drawn from both other employment and other activities, then the economic opportunity cost is a weighted average of the willingness to pay in the forgone employment and the minimum supply price.

As on the output side, any difference between the economic opportunity costs of the resources employed by a project and their market cost, can be considered an economic externality. Hence, there are two ways in which to estimate the economic opportunity cost of a project's inputs, namely: (a) Use Harberger's principles of willingness to pay, supply price, and "a rupee is a rupee" to measure economic costs directly; or (b) Estimate the appropriate adjustment or economic externality and add it to the corresponding financial cash outflows. The adjustment that might have to be made in this case is to include any economic rent that is earned by the owners of an input; this rent is comparable to any change in consumers' surplus on the output side.

Taxes paid by a firm as a result of a project such as income tax, property and municipal tax and other business taxes are a private cost, but not necessarily a cost to the economy. This is why items (c), (d) and (e) under cash disbursements have an economic cost of zero.

In addition to these immediate externalities there is a broader set of external effects that also has to be taken into account in the economic analysis.

- The financial price of utilities is often fixed by the government and it may be quite different from its economic value.
- The firm proposing a project considers only the private cost of any required on-site infrastructure whereas the economic analysis should include the economic cost of both the on-site and off-site infrastructure, such as improved transportation facilities or the added capacity of public utilities.
- Foreign debt or equity financing may generate added economic benefits or costs not included in the financial appraisal.
- A project may cause increased environmental damage which is excluded from the private financial analysis, but should be included as an economic cost.
- A project may create a basic needs externality if it improves the provision of basic needs to the most needy segments of society.

The estimates of incremental economic benefits and costs should be discounted by an economic discount rate. Since economic benefits and costs can estimated by adding economic externalities to their corresponding financial cash flows, both the externalities and the financial cash flows have to be discounted by the economic discount rate as well.

Part 10: Estimation of Economic Prices of Tradable Goods and Services

Introduction

Projects affect economic well-being in a country. To analyze the economic worth of a project it is important to know the true economic values of its inputs and outputs. In order to get these true economic values we need to know:

- Whether the goods are tradable or nontradable;
- How distortions such as tariffs, taxes, and subsidies create a wedge between economic and financial values of both tradable and nontradable project's inputs and outputs;
- How the transportation and handling costs of inputs and outputs affect the true economic values of goods and services used and produced by a project; and
- How distortions also create a divergence between the market and the economic exchange rates, the financial and economic costs of capital and financial and economic wage rates.

This Part explains the above concepts and shows in detail how to obtain the true economic prices of tradable goods and services.

Project appraisal emphasizes the difference between the financial and economic values of inputs and outputs particularly when distortions exist in either the demand or supply side of markets for goods and services. As such, the concept of a conversion factor (CF), defined as the ratio of the economic price to the financial price, plays an important role in looking at the financial and economic costs or benefits of a project. For a given good or service, the term Commodity Specific Conversion Factor (CSCF) is used in lieu of the general term of conversion factor (CF). If we know the conversion factor specific to project's inputs and outputs in addition to the economic costs of capital and foreign exchange, we can easily translate the financial appraisal of a project into its economic valuation. While commodity specific conversion factor values and economic cost of labor may be different when calculated at project sites, economic parameters such as economic cost of capital and foreign exchange are national parameters that remain constant, at given time, across projects in the overall economy.

If there are no distortions in the supply and demand market of a commodity, then the CSCF will simply be 1 because the economic and financial prices are the same. If the market for foreign exchange is distorted, the market exchange rate (E^m) or the official exchange rate (OER) will not accurately reflect the economic value of a unit of foreign exchange in relation to the domestic currency. Thus, it is essential to make an adjustment for the divergence between the market or official price of foreign exchange and its economic price, also referred to as the economic exchange rate (E^e) or sometimes as the shadow exchange rate (SER). For a detailed discussion on how to calculate E^e please refer to Annexure 1.

In the case of a tradable commodity, it is important to make a distinction between economic values at the port and at the project site. This difference is due to the economic costs of domestic handling and transportation to move the commodity from port to the project site or vice versa. The later sections explain how to estimate *the economic price of tradable goods*

at the port by adjusting for trade and foreign exchange distortions. As mentioned earlier several distortions such as tariffs, taxes and subsidies create differences between the economic and the financial price of a tradable goods. Economic prices are those that account for the real resources consumed or produced by the project and hence do not include tariffs, taxes or subsidies as these are merely transfers between the consumers, the producers and the government all within the same economy. Financial prices are market prices, which naturally incorporate all the tariffs, taxes and subsidies. This section, therefore, also clarifies how to account for the effect of Foreign Exchange Premium (FEP)[28] when estimating economic prices in domestic currency for an importable and an exportable good.

Tradable and Nontradable Goods

A good or service is considered tradable when an increase in demand (supply) by a project does not affect the amount demanded (supplied) by domestic consumers (producers). The increase in demand (supply) by a project is eventually reflected as an increase/decrease in imports or a decrease/increase in exports depending on whether the project is demanding or supplying the importable or exportable commodity. Importable goods include imported goods and all goods produced and sold domestically that are close substitutes for either the imported goods or potentially imported goods. Exportable goods include exported goods and domestic consumption of goods of same type or close substitutes for the exported goods. An increase in demand for an importable commodity by a project results in an increase in demand for imports. An increase in demand for an exportable commodity by a project results in a reduction in exports. Alternatively, when the project produces an importable commodity, there will be a reduction in imports; when the project produces an exportable, there will be an increase in exports.

A commodity or service is "nontradable" from a country's point of view if its domestic price lies above its FOB export price or below its CIF import price.[29] The international transportation cost may be very high compared to the value of the product so that no profitable trade is feasible. Alternatively, an importable good will become nontradable if it receives such a high level of protection in the form of trade quotas or prohibitive tariffs that no import transactions will take place.

Estimation of Economic Prices at the Port: Adjusting for Trade Distortions and Foreign Exchange

The difference between the financial costs of a tradable commodity at port and at project site is the financial cost of transportation and handling between the port and the project. Likewise, the economic price of a tradable at port will also differ from the economic price at project site because of the economic cost of handling and transportation between port and project being different from the financial cost.

[28] Foreign Exchange Premium (FEP) is the percentage difference between the Economic Exchange Rate and the Official Exchange Rate. Thus, it is a measure of the divergence between the Economic Exchange Rate and the Official Exchange Rate due to distortions in the markets for tradables. Note that the market for foreign exchange is derived from the demand and supply of a country's tradable goods. Numerically, FEP = (Ee/OER)-1.

[29] FOB price implies "free on board" export price and it is the price of a good at the border before it is shipped abroad. Thus, it includes transportation and handling in moving the good to the port. CIF price implies "costs of insurance and freight" import price and it is the price at the border before any transportation and handling is incurred to move the good to the project site.

The economic cost of an importable input or the benefit from an import substitute output is measured by its CIF price. Similarly, the economic benefit from an exportable output or the economic cost of an exportable input is measured by its FOB price. When these prices are quoted in units of foreign exchange they directly measure economic costs or benefits at the port. However, when these are to be expressed in units of domestic currency, they have to be multiplied by the economic exchange rate. That is to say, they have to be not only multiplied by the official exchange rate but the foreign exchange premium component also has to be added to reflect the true economic values in domestic currency, at the port.[30]

CIF and FOB prices are economic values of traded goods at the country's port when expressed in units of foreign currency. It is possible to calculate economic values of traded goods expressed in units of domestic currency including the foreign exchange premium. If the CIF/FOB price is known, then multiplying the CIF or FOB with the official exchange rate and, thereafter, adding the foreign exchange premium effect will give us the desired economic value in domestic currency including the foreign exchange premium (FEP). On the other hand, if only the domestic financial price (expressed in units of domestic currency and including distortions) at the port is known, then to arrive at the final economic value in domestic currency including the FEP effect, we carry out a two-stage adjustment. We first remove the distortions built into the financial price of the good, the distortions being the taxes and subsidies on that particular good and then adjust the undistorted financial price with the FEP. This two-stage adjustment allows us to calculate the economic price of a good in the domestic currency including the FEP effect.[31]

Project appraisal emphasizes the difference between the financial and economic values of inputs and outputs particularly when distortions exist in either the demand or supply side of markets for goods and services. As such, the concept of a conversion factor (CF), defined as the ratio of the economic price to the financial price, plays an important role in looking at the financial and economic costs or benefits of a project.

Examples Showing the Calculation of Financial and Economic Prices

The following three examples show how to calculate financial and economic prices at the port.

Example 1: The Import of Pneumatic Tires (with an import duty)

(The figures in this example are assumed for illustrative purposes only)

Consider a project that imports pneumatic tires into the India. There is a 30 percent tariff on imports of pneumatic tires and a 10 percent value added tax (VAT). The first steps in calculating the financial and economic prices of tires at the port are as follows:

CIF Price of Tires
USD 40
Import Tariff

[30] Numerically, $P^e=P^w*OER*(1+FEP)$, where P^e= economic value; P^w= world financial price, either CIF or FOB (e.g.in USD); OER= Official Exchange Rate INR/USD); FEP= Foreign Exchange Premium.

[31] Numerically, the economic price adjusted for foreign exchange premium, $P^e = (P^d * CSCF) * (1 + FEP)$, where P^d = domestic financial price at the port; CSCF = commodity-specific conversion factor at port.

30% of CIF
Sales Tax or VAT
10% of (CIF + Tariff)
Official Exchange Rate (OER)
INR 45/USD

Tariff 30%
0.3*40 = USD 12
Price of Tires with Tariff
USD 40 + USD 12 = USD 52
Sales tax or VAT 10%
0.1*52 = USD 5.20

Financial Price of Tires in foreign currency
= CIF + Tariff + VAT
= USD 40 + USD 12 + USD 5.20
= USD 57.20

Economic Price of Tires in foreign currency
= CIF Price
= USD 40

Financial Price of Tires in domestic currency
= 57.20 * INR 45
= INR 2574
Economic Price of Tires
Before adjustment for
= 40 * INR 45
FEP (in domestic currency)
= INR 1,800

The economic price in domestic currency calculated above has been derived as the product of the CIF price and the market exchange rate. This calculation does not take into account the fact that trade subsidies and taxes in the economy (such as import tariffs and export taxes) have an overall effect on the market of foreign exchange and, hence, cause the economic price of foreign exchange to differ from the market or official price of foreign exchange. Consequently, there is a foreign exchange premium. If we assume the economic exchange rate (E^e) to be INR 50/USD 1, we can account for the effect of the FEP in the following manner:

Economic exchange rate (E^e)
= INR 50/ USD 1
Foreign Exchange Premium (FEP)
= (E^e / OER) - 1

= (50 /45) - 1

= 0 .111
Economic Price of Tires in domestic currency,
after first step
= INR 1,800

Economic Price of Tires in domestic currency, including effect of FEP:
= 1,800 * (1 + FEP)
= 1,800 * (1 + 0.111)
= INR 2000

Conversion Factor (E^e / E^m)
= 2000/2574 = 0.777

The economic price of a pneumatic tire at the port in domestic currency taking into account the effect of the FEP is, therefore, INR 2,000.

To summarize, although we have first calculated financial prices in domestic currency in this example, the economic value in domestic currency at the port including the FEP effect can be calculated directly from the CIF price as follows:

Economic Price of Tires in domestic currency
= [CIF (in USD) * OER]* (1 + FEP)

with the FEP
= USD 40 * 45/USD * (1.111)
= INR 2,000

If we were starting with the financial price in domestic currency, we could calculate the economic price as follows:

Economic Price of Tires
in domestic currency
= [P^d * (1 + FEP)] / [(1 + Tariff)*(1+ VAT)]
with the FEP effect
=(2574 * 1.111) / [(1.3 * 1.1)]
= 2,000

Example 2: The Export of Shoes (with an export subsidy)

(The figures in this example are assumed for illustrative purposes only)

Consider a project in India that exports shoes. The FOB price at the port is USD 200 per dozen pair of shoes. Although there is no actual subsidy on shoes production in the country now, for illustrative purposes we will assume a 10 percent subsidy in this example. This will cause the domestic market price to rise above the FOB price. The first steps in calculating the financial and economic prices of shoes are as follows:

FOB Price
= USD 200
Subsidy (K)=10% FOB
= 0.1*200 = USD 20

Financial Price of Shoes
= FOB + K
in foreign currency
= 200 + 20 = USD 220

Economic Price of Shoes
in foreign currency

Financial Price of Shoes
= 220 * INR 45 = INR 9,900
in domestic currency

Economic Price of Shoes in domestic
= 200 * INR 45 = INR 9,000
currency before FEP adjustment

The economic price of shoes calculated above is the product of the FOB price in foreign currency and the official exchange rate. This approach does not take into account the fact that trade subsidies and taxes in the economy have an overall effect on the market for foreign exchange and, hence, cause the economic price of foreign exchange to differ from the market price of foreign exchange. Consequently, there is a foreign exchange premium. We account for the effect of the FEP in the following manner:

Economic exchange rate (E^e)
= INR 45/USD
Foreign Exchange Premium (FEP)
= E^e/OER - 1
= 50/45 - 1
= 0.111

Economic Price of Shoes in domestic currency, after first step (above)
= INR 9,000

Economic Price of Shoes in domestic currency, including effect of FEP:
= 9,000 * (1 + FEP)
= 9,000 * (1 + .111)
= 10,000

Conversion Factor (E^e / E^m)
= 10000/9900 = 1.0101

The economic price of shoes at the port in domestic currency, taking into account the effect of the FEP is, therefore, INR 10,000.

To summarize, although we have first calculated financial prices in domestic currency in this example, the economic value in domestic currency at the port including the FEP effect can be calculated directly from the FOB price as follows:

Economic Price of Shoes
=[FOB (in USD) * OER] * (1 + FEP)
in domestic currency
= USD 200 * INR 45/USD * (1.11)
with the FEP effect
= INR 10,000

If we were starting with the financial price in domestic currency, we could calculate the economic price as follows:

Economic Price of Shoes
in domestic currency
= [P^d * (1 + FEP)] / (1 + Subsidy)
including FEP
= (9,900 * 1.11) / (1 + 0.1)
= 10,000

Example 3: The Export of Garments (with an export tax)

(The figures in this example are assumed for illustrative purposes only)

Consider a project that exports men's and women's outer garments. The FOB price at the port is USD 800 per hundred pieces of garments. Although there is no actual export tax on garments export in the India now, for illustrative purposes we will assume an export tax in this example. Assume there is a 5 percent export tax on all garments exports from India. This will cause the domestic market price to fall below the FOB price. The first steps in calculating the financial and economic prices of garments are as follows:

FOB Price
= USD 800
Export tax (t_x) = 5% FOB
= 0.05*800 = USD 40

Financial Price of Garments
= FOB - t_x
in foreign currency
= 800 - 40 = USD 760

Economic Price of garments
= FOB Price = USD 800
in foreign currency

Financial Price of garments
= 760 * INR 45 = 34,200
in domestic currency

Economic Price of garments
= 800* 45
= INR 36,000
in domestic currency before FEP adjustment

The economic price of garments calculated above is the product of the FOB price in foreign currency and the official exchange rate. This approach does not take into account the divergence between the economic price of foreign exchange and the market price of foreign exchange, that is, the foreign exchange premium. We account for the effect of the FEP in

the following manner:

Economic exchange rate (E^e)
= INR 50/USD

Foreign Exchange Premium (FEP)
= E^e/OER - 1
= INR 50/45 - 1
= 0.111

Economic Price of garments in domestic currency,
after first step (above)
= INR 36,000

Economic Price of garments in domestic currency,
including effect of FEP:
= INR 36,000 * (1 + FEP)

= INR 36,000 * (1 + .111)

= INR 40,000

The economic price of garments at the port in domestic currency, taking into account the effect of the FEP is, therefore, INR 40,000.

To summarize, although we have first calculated financial prices in domestic currency in this example, the economic value in domestic currency at the port including the FEP effect can be calculated directly from the FOB price as follows:

Economic Price of garments
= [FOB (in USD) * OER] * (1 + FEP)
in domestic currency
= USD 800 * INR 45/USD * (1.111)
with the FEP effect
= INR 40,000

If we were starting with the financial price in domestic currency we could calculate the economic price as follows:

Economic Price of Garments
in domestic currency
= [P^d * (1 + FEP)] / (1 – tax)
including FEP
= (INR 34,200 * 1.11) / (1 - 0.05)
= INR 40,000

Estimating Commodity-specific Conversion Factors

As explained earlier, economic distortions drive a wedge between financial and economic prices of goods and services. It is convenient to determine the conversion factor of a commodity at port. But such a conversion factor excludes the economic cost of domestic handling and transportation from port to project site and vice versa.

Recall that the estimation of economic prices for tradable goods makes use of the Foreign Exchange Premium (FEP). Since a commodity's CSCF is its economic price divided by its financial price, the CSCF for tradable goods at the port (i.e., before considering transportation and handling costs), can then be calculated as follows:

1. For importable goods at the domestic currency, given no quantitative restrictions:

$$CSCF_d \text{ (port)} = (1 + FEP)/ \{(1 + T)*(1 + T_1)*(1 + T_2)...\}$$

where:
T = rate of import tariff
T_1, T_2, etc. = other taxes, sales, excise, and value added taxes

2. For exportable goods at domestic currency, given no quantitative restrictions:

$CSCF_d$ (port) = (1 + FEP)/{(1 - t_x)(1 + VAT)}

where
t_x = export tax rate[32]
VAT = value added tax

Note: If a project is exempt from paying the VAT on any of its traded inputs, the financial price of this traded good will be lower than the financial price in a nonexempt case, which will cause the CSCF for that good to be higher.

Estimation of Economic Prices at the Project: Adjusting for Handling and Transportation Costs

Up to this point we have been discussing economic values of a commodity at the port. It is important to make a clear distinction between a commodity's value at port and a commodity's value at the project site. As explained below, a commodity's economic value will generally differ from one project site to another due to differences in handling and transportation costs.

The CIF price of an importable good and the FOB price of an exportable good give us the economic prices in foreign currency of an item at the port. There will, however, be additional costs of handling and transportation between the port and the location of the project. To estimate the economic cost of an importable input used by a project, the economic costs of domestic transportation and handling should be added to the economic price of this good.[33]

Alternatively, if we are evaluating the economic benefit of an exportable output produced by a project, the economic costs of domestic transportation and handling should be subtracted from the economic price at port to find the economic benefit of the output evaluated at the project site.

The handling and transport sectors use, in addition to labor, items such as petroleum products, cranes and lifts, and motor vehicles as inputs. As a consequence, the handling and transportation costs have both tradable and nontradable components which may be taxed or subsidized. The economic costs of these items may, therefore, be significantly different from their financial prices. The following two examples show how handling and transportation costs affect the economic value of a commodity.

In a nutshell, following four cases arise in the estimation of economic benefit and cost of importables and exportables including costs of handling and transportation. In each case, first the financial cost or benefit is computed and then it is adjusted for distortions and foreign exchange premium to arrive at economic costs and benefits.

(1) Economic Cost of an Importable Used by a Project as an Input

Financial Cost of Imported input at the project site:

CIF at port
+ Tariff and Countervailing Duty if any
+ Port Charges Including Tax/subsidy

[32] An export subsidy would be entered as a negative tax.
[33] Economic values for transportation and handling are likely to be different from their market costs due to distortions in their respective input markets.

+ Freight including tax/subsidy from port to project site

Price paid at the Project site

The economic cost of the imported magnets will be:

CIF adjusted for Forex Premium
+ Economic Values of Port Charge
+ Economic Values of Freight from port to project

(2) Economic Benefit of an Importable Produced by a Project (Import Substitution)

Financial Benefit of production by the project equals costs savings to user units from not importing the materials minus the cost of transportation from the plant to the market or the user unit. The economic benefit is calculated from the financial benefit after adjusting for distortions and foreign exchange premium.

Thus, financial benefits are:

CIF at importing port
+ Tariff
+ Port Charges Including Tax/subsidy
+ Freight and Insurance including tax/subsidy from port to market or user unit
Importer's Price
- Transport Charges from Mine to Power Plant

Financial Price at the site of the project

The economic benefit (price) of import substitution product produced by the project will be the economic value of the savings to the economy from not importing that product:

CIF Adjusted for Forex Premium
+ Economic Value of Port Charges
+ Economic Value of Freight and Insurance from port
- Economic Value of Transport Cost from project to user unit or the market

(3) Economic Benefit of an Exportable Produced by a Project

Economic benefit of the exported items is estimated by first calculating its financial price (benefit) and then adjusting it for distortions and foreign exchange premium:

Financial Price of Exported item produced by the project:

FOB at the port
+/- Subsidy/tax
- Freight and insurance from project to port inclusive of tax/subsidy, if any
-Port Charges at the Port inclusive of tax/subsidy, if any

Price Received by the project

The Economic Benefit (price) of exported item will be:

FOB Adjusted for Forex Premium
- Economic Value of Freight and Insurance from project to port
- Economic Value of Port Charges

4. Economic Cost of an Exportable Used by a Project

Financial cost will be loss from not exporting plus transport cost from project to market or user unit. The economic costs will be computed from financial cost with adjustment for distortions and foreign exchange premium.

The financial cost of using exported item:

FOB at the port
- Port Charges inclusive of tax/subsidy if any
- Freight from project to port and Insurance inclusive of tax/subsidy if any

Price Received by the exporting unit

+ Freight and Insurance from exporting unit to market or project

Price paid by the project using the exported materials as input

The economic cost of the exported item used as input by the project will be:

FOB Adjusted for Forex Premium
- Economic Value of Port Charges
- Economic Value of Freight and Insurance from exporting unit to port
+ Economic Value of Freight and Insurance from exporting unit to project/market

Below are two numerical examples of computing economic cost and benefit after adjusting for distortions, foreign exchange premium and costs of transportation and port handling.

Example 4: A Project Importing Pneumatic Tires

(These figures are assumed for illustrative purposes only)

Consider, once again, the imports of pneumatic tires. Suppose that the financial cost of handling exclusive of a 20 percent VAT is INR 15 per tire; hence the financial cost of handling inclusive of tax is 15 * (1 + 0.20) = INR 18 per tire. The financial cost of transportation from the port to the assembly plant (after taking into account a 10 percent subsidy) is INR nine per tire. The subsidy is expressed as a percentage of production costs. The financial and economic costs of a tire as an input to car assembly are calculated below:

Financial Cost at Assembly Plant = Financial Price at Port + Financial cost of Domestic Transportation + Financial Cost of Handling

= (INR 2,574 + INR 9 + INR 18) = INR 2,601

To obtain the final economic cost of a tire including transportation and handling, we begin with the economic price of a tire in domestic currency at the port as calculated in earlier section. After we adjust handling and transportation costs for their distortions and for the foreign exchange premium, we add the economic cost of handling and transportation to the economic price of a tire at the port to obtain the final economic cost of tires at the project site. It is assumed that transportation is made of 60 percent tradable content and handling is made of 80 percent tradable content, and hence, their 60 percent and 80 percent costs, respectively, are adjusted for FEP.

Economic Cost of Tire at the port (in domestic Currency including FEP) = INR 2,000

Economic Cost of Transport = [Financial Cost / (1-Subsidy)] * (1 + 0.6*FEP)
= (INR 9/0.9) * 1.07 = INR 10.7
Economic Cost of Handling = [Financial Cost / (1+Tax)] * (1 + 0.8*FEP)
= (18/1.2) * 1.09 = INR 16.35
Economic Cost of Tire at project site
= 2,000 + 10.7+ 16.35= INR 2027

Conversion factor including costs of transportation and handling = 2027/2601 = 0.779

Example 5: A Project Exporting Shoes
(These figures are assumed for illustrative purposes only)

Similar adjustments should be made for the export of shoes. Suppose that the handling charges exclusive of a 20 percent VAT are 56 rupees per dozen shoes and the transportation charges from the factory to the port (after taking into account a 10 percent subsidy) are 80 rupees per dozen shoes. Hence,

Financial Cost of Domestic Transportation
= INR 80
Financial Cost of Handling = Net-of-tax Cost of Handling * (1+Tax)
= INR 56 * 1.2

= INR 67.20

Financial Price at Factory Gate = Financial Price at Port - Financial Cost of Domestic Transportation - Financial Cost of Handling
= (INR 9,900 – INR 80 – INR 67.20)
= INR 9,752.80

To obtain the final economic value including transportation and handling, we begin with the economic price of shoes in domestic currency at the port (including the FEP component) as calculated in the previous section. We then adjust handling and transportation costs for their distortions and for the foreign exchange premium, and thereafter, we subtract the adjusted economic values of transport and handling from the economic prices of shoes to obtain the economic prices of shoes at the project site. It is assumed that transportation is made of 60 percent tradable component and handling is made of 80 percent tradable content, and hence, their costs are adjusted for FEP as follows.

Economic Cost of Shoes (in domestic currency including FEP)
= INR 9,000*1.11 = INR 10,000

Economic Cost of Transport = [Financial Cost / (1-Subsidy)] * (1 + 0.6*FEP)
= (INR 80/0.9) * 1.07
= INR 94.81

Economic Cost of Handling = [Financial Cost / (1+Tax)] * (1 + 0.8*FEP)
= (INR 56/1.2) * 1.089
= INR 50.80 rupees

Economic Value of Shoes at project site = 10,000-94.81-50.80 = 9,854.40 rupees

Conversion factor with transportation and handling costs = 9854.4/9752.80 = 1.0104

Part 11: Estimation of Economic Prices for Nontradable Goods and Services

Introduction

The three basic postulates for applied welfare economics are the fundamental foundations for the economic appraisal of investment projects. The first postulate states that the competitive demand price for a given unit of an item measures the value of that unit to the demander and is otherwise known as *the willingness to pay* by the demander. The second postulate states that the competitive supply price for a given unit of a good or service measures the value of that unit to the supplier or otherwise known as the concept of *opportunity cost*.[34] These economic prices of goods and services used for economic analysis are derived by adjusting the market or financial prices for distortions. Financial prices are used to construct financial cash flows and are essentially the starting point for conducting the appraisal of any project. Thus, it is imperative to develop a strong financial analysis before proceeding to undertake the economic appraisal.

In the previous Part, we observed that the estimation of the economic costs or benefits for tradable goods associated with a project was based on the world demand or world supply price. However, in the case of nontradable goods or services the estimation of the economic costs or benefits will be based on the weighted average of both demand and supply prices.[35] The framework for estimating the economic benefits and costs in undistorted markets is discussed first, followed by the methodology for the nontraded goods in the presence of distortions or externalities. This is followed by applications of the methodology, illustrated with examples.

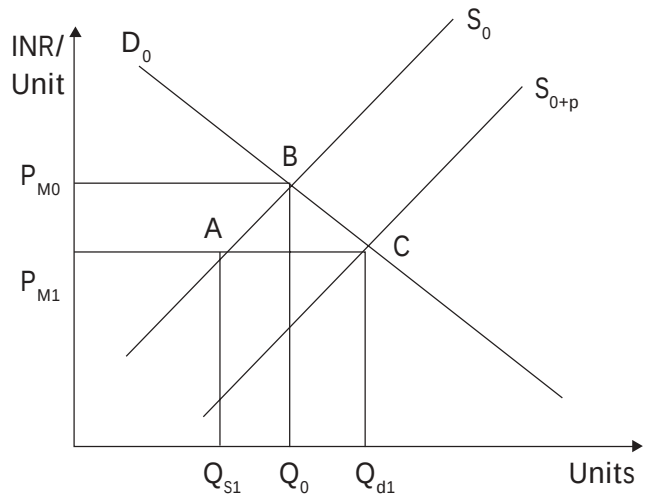
Analyzing the Economic Benefits of an Output Produced by a Project in an Undistorted Market

Consider the case of a new *project* and suppose our project produces a nontradable goods such as concrete. The figure below shows the supply and demand for this nontradable goods. The industry demand and supply curves prior to the introduction of the new project are denoted by D_0 and S_0, respectively. The new project produces a quantity Q_p and results in a shift in the industry supply curve from S_0 to S_{0+P}. The additional supply by the project results in a drop in the market price from P_{m0} to P_{m1}. As a result of the decrease in price, consumers demand more and total consumption increases from Q_0 to Q_{d1}. Also due to the decline in price, existing suppliers will cut back their production from Q_0 to Q_{s1} as some of them can no longer supply the same amount of the good at the new (lower) price P_{m1}. Q_p, the quantity produced by the project, equals the sum of the two quantities Q_0-Q_{d1} and Q_0-Q_{s1}.

Since the project sells its output at the new prevailing market price P_{m1}, the gross financial receipts to the project are given by $Q_p * P_{m1}$. To estimate the gross economic benefits of the project, we need to determine the economic value of the new consumption to the demanders, and the value of the resources released by existing suppliers. These values are

[34] For a detailed discussion of the postulates, see Harberger, Arnold C., "Three Basic Postulates for Applied Welfare Economics: An Interpretive Essay," *Journal of Economic Literature* p. 785-97, September 1971.
[35] Asian Development Bank, Economics Office, "Guidelines For Economic Analysis of Projects" (1987), pp. 13-14.

Figure 11.1: Economic Benefits of a New Project in an Undistorted Market



estimated using the first two postulates as follows:

(i) The additional consumption is valued, according to the first postulate, by the demand price for each successive unit, or by the area under the demand curve (Q_0BCQ_{d1}); and

(ii) The resources released by other producers are valued, according to the second postulate, by the supply price (resource cost) of each successive unit or by the area under the supply curve (Q_0BAQ_{s1}).

The gross economic benefits are given by the sum of the two areas above ($Q_{s1}ABCQ_{d1}$). It is important to emphasize that these benefits are gross. In other words, we have not netted from them the economic costs of producing these goods yet. Saying that a project has positive gross economic benefits is the economic equivalent of saying that a project has positive gross financial receipts. The positive gross benefits alone do not indicate whether the project is economically viable or not, the same way as positive gross financial receipts do not indicate whether the project is financially profitable or not.

It is worth noting that the gross economic benefits are equal to the sum of the financial receipts to the projects' owners ($Q_{s1}ACQ_{d1}$), plus the gain in consumer surplus ($P_{m0}BCP_{m1}$), less the loss in producer surplus ($P_{m0}BAP_{m1}$). In addition to the gross receipts to the project owners, consumers gain due to the reduction in price and producers lose economic rents due to the reduction in price. From a distributional perspective, it is interesting to note that consumers' gain fully offsets the loss in economic rents to the existing producers. It may be noted that the changes in consumer and producer surplus result from the price drop.

It is often the case that the quantity produced by the project is relatively small compared to the size of the market and there is no change in the market price. In such a situation and given that

we are operating in an undistorted market, the gross financial receipts will be equal to the gross economic benefits. In other words, there is no difference between the financial revenues generated by a project and its economic benefits to the society. The difference arises only when the project has a big impact on the industry.

Analyzing the Economic Cost of an Input Demanded by a Project in an Undistorted Market

This example demonstrates how the economic cost of a nontradable item demanded by a project can be estimated using Harberger's postulates. The industry demand and supply curves without the additional demand by the new project are denoted by D_0 and S_0, respectively (Figure 11.2). The new project demands a quantity Q_p and results in a shift in the industry demand curve from D_0 to D_{0+P}. The additional demand by the project results in a rise in the market price from P_{m0} to P_{m1}. As a result of the increase in price, existing consumers will cut back their consumption from Q_0 to Q_{d1} and producers will increase their production from Q_0 to Q_{s1} at the new (higher) price P_{m1}. Q_p, the quantity demanded by the project, equals the sum of the two quantities Q_0-Q_{d1} and Q_0-Q_{s1}.

The project buys its requirement at the new prevailing market price P_{m1}, and incurs a gross financial expenditure of $Q_p * P_{m1}$. To estimate the gross economic costs of the input demanded by the project, we need to determine the economic value of the consumption that is foregone by the existing consumers, and the value of the additional resources utilized to accommodate the project's demand. These

Financial prices are used to construct financial cash flows and are essentially the starting point for conducting the appraisal of any project. Thus, it is imperative to develop a strong financial analysis before proceeding to undertake the economic appraisal.

values are estimated using the first two postulates as follows:

(i) The cutback in consumption is valued, according to the first postulate, by the demand price for each successive unit given up or by the area under the demand curve (Q_0BCQ_{d1}); and

(ii) The additional resources used to accommodate the expansion in output are valued, according to the second postulate, by the supply price (resource cost) of each successive unit or by the area under the supply curve (Q_0BAQ_{s1}).

The gross economic cost for this input is given by the sum of the two areas above ($Q_{s1}ABCQ_{d1}$). By determining the economic cost of each input used by the project in a similar way, and the economic benefit of its output as outlined above, we will be in a position to determine the economic viability of the project by subtracting all economic costs from the gross economic benefits.

Economic Prices for Nontraded Goods in Distorted Markets

Analyzing the economic benefits of an output produced by a project in a distorted market

Suppose that the market for an industry's output is distorted by a value added tax (VAT). The tax will drive a wedge between the maximum price

that consumers are willing to pay for successive units of the good and the net of tax (effective demand) price they pay to the supplier. D_0 is the gross-of-tax (undistorted) demand curve that measures consumers' willingness to pay, and D_{0net} is the net-of-tax or effective demand curve that reflects the prices consumers are prepared to offer producers. D_{0net} lies below and to the left of the original curve, D_0, because the prices that consumers are prepared to offer to suppliers for successive units of the goods are now reduced by the amount of the VAT. The market-clearing price, P_{m0}, and quantity, Q_0, are determined by the intersection of the net-of-tax demand curve, D_{0net}, and the supply curve, S_0, as shown in Figure 11.3. While suppliers receive P_{m0}, which is equal to the resource cost of the marginal unit produced, consumers have to pay the VAT in addition to the market price P_{m0}. The price that consumers pay is P_{d0}.

The above situation depicts the market without the new project. To determine the gross economic benefits of a new project in this market, we follow the same logic and mechanics used to estimate the economic value of a project's output in an undistorted market in earlier section. The new project produces a quantity Q_p and results in a shift in the industry supply curve from S_0 to S_{0+P}. The additional supply by the project results in a drop in the market price from P_{m0} to P_{m1} and subsequently in the demand price from P_{d0} to P_{d1}. As a result of the decrease in price paid by consumers, they increase their consumption from Q_0 to Q_{d1}. Also due to the decline in price, existing suppliers will cut back their production from Q_0 to Q_{s1} as some of them can no longer supply the same amount of the good at the new (lower) price P_{s1}. Q_p, the quantity produced by the project, equals the sum of the two quantities Q_{d1}- Q_0 and Q_0-Q_{s1}.

Since the project sells its output at the new prevailing market price P_{m1} (which is also equal to the supply price, P_{s1}), the gross financial receipts to the project are Q_p * P_{s1}. To estimate the gross economic benefits of the project, we need to determine the economic value of the

Figure 11.2: Economic Cost of an Input Demanded by a Project in an Undistorted Market

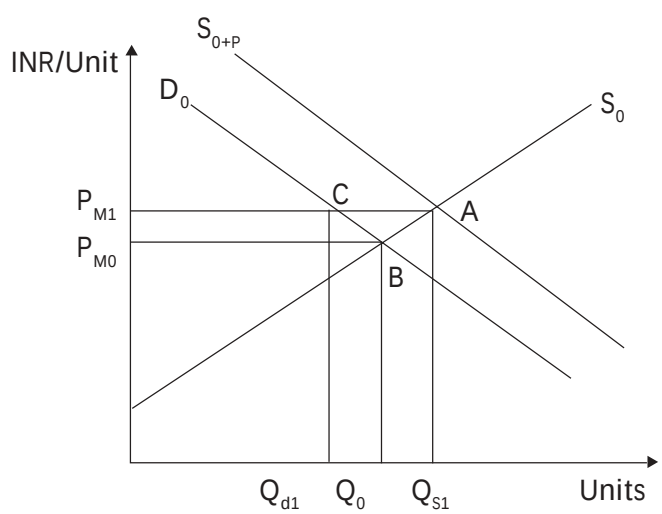
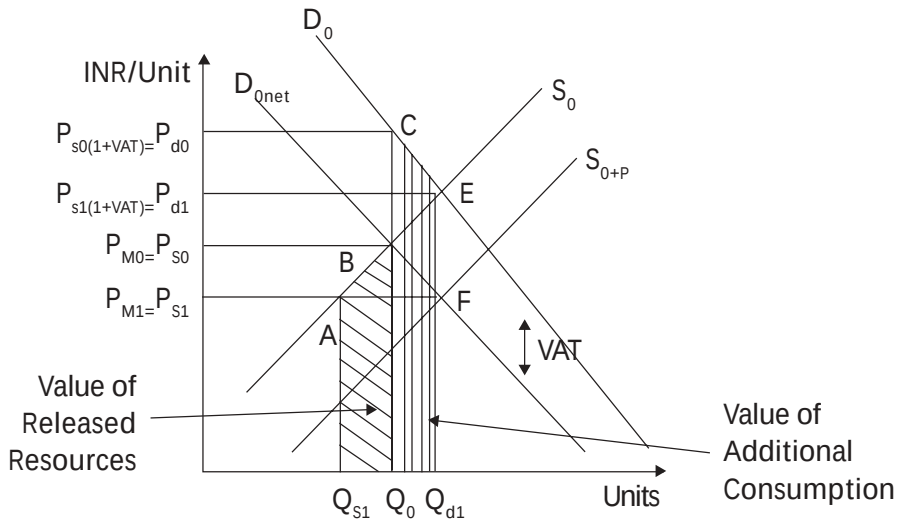


Figure 11.3: Economic Benefits of a New Project in a Distorted Market



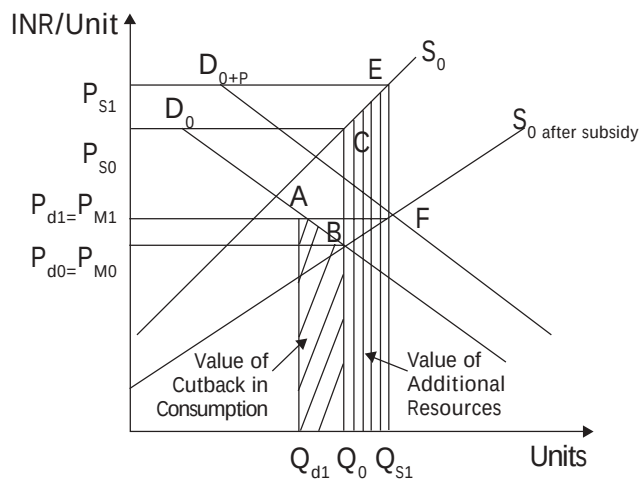
new consumption to the demanders, and the value of the resources released by existing suppliers. Following the first postulate, the value of additional consumption is measured by area under the undistorted (gross-of-tax) demand curve — the area Q_0BCEFQ_{d1}. Following the second postulate, the value of resources freed is measured by area under the supply curve — the area Q_0BAQ_{s1}. The gross economic benefits are the sum of these two areas: $Q_{s1}ABCEFQ_{d1}$.

Strictly speaking, we have concluded the estimation of the gross economic benefits of the project. It would be interesting, however, from a distributional perspective to determine who has gained and who has lost as a result of the project. The gross economic benefits can be broken down into the gross receipts — net of VAT — to project owners ($Q_{s1}AFQ_{d1}$); the gain in consumer surplus ($P_{d0}CEP_{d1}$); the loss in producer surplus ($P_{s0}BAP_{s1}$) and gain in government tax revenues ($P_{d1}EFP_{s1}$- $P_{d0}CBP_{s0}$).

Analyzing the economic costs of an input demanded by a project in a distorted market

Suppose that the market for one of the project's inputs is distorted by a subsidy. The subsidy will drive a wedge between the true resource cost of the successive units of the good and the prices that suppliers are now willing to charge consumers (Figure 11.4). S_0 is the before-subsidy supply curve, which measures the true resource cost of the units produced; and $S_{0\ after\ subsidy}$ is the after-subsidy supply curve that reflects the prices that suppliers are prepared to charge consumers. $S_{0\ after\ subsidy}$ lies below and to the right of the original curve, S_0, because the prices that suppliers are willing to charge consumers for the successive units of the goods are now reduced by the amount of the subsidy they receive from the government. The market clearing price, P_{m0}, and quantity, Q_0, are determined by the intersection of the after-subsidy supply curve, $S_{0\ after\ subsidy}$, and the demand curve, D_0, as depicted in the figure.

Figure 11.4: Economic Cost of Input Demanded by a Project in a Distorted Market



While consumers pay P_{m0}, which is equal to their willingness to pay for the marginal unit consumed, producers will receive a government subsidy in addition to the market price, P_{m0}, they receive from consumers. The price per unit, that suppliers finally receive which also reflects the resource cost of the marginal unit, is P_{s0}.

Now, suppose, a project demands an input in this market. To determine the gross economic costs of this input, we follow the same logic and mechanics used to estimate the economic cost of an input in an undistorted market as outlined earlier. The new project demands a quantity Q_p and results in a shift in the industry demand curve from D_0 to D_{0+P}. The additional demand will bid up the market price of the input from P_{m0} to P_{m1} and subsequently the supply price from P_{s0} to P_{s1}. The increase in price will result in additional production by suppliers from Q_0 to Q_{s1}, and a cutback in consumption by the existing demanders from Q_0 to Q_{d1}. Q_p, the quantity demanded by the project, equals the sum of the two quantities Q_0-Q_{d1} and Q_{s1}-Q_0 .

The economic cost of the project's input is measured by the value of the additional resources used to accommodate the expansion in production from Q_0 to Q_{s1}, and the value of the cutback in consumption by existing consumers.

The economic cost of the project's input is measured by the value of the additional resources used to accommodate the expansion in production from Q_0 to Q_{s1}, and the value of the cutback in consumption by existing consumers. Following the second postulate, the value of additional resources used is measured by area under the before-subsidy supply curve — the area Q_0BCEFQ_{s1}. Following the first postulate, the value of the postponed consumption by other demanders is measured by the area under the demand curve — the area Q_0BAQ_{d1}. The gross economic cost is the sum of these two areas: $Q_{d1}ABCEFQ_{s1}$.

For the distributional analysis of the project's demand, we can breakdown the economic costs of the input into its financial expenditures after subsidy paid by the project ($Q_{d1}AFQ_{s1}$); the loss

in consumer surplus ($P_{d1}ABP_{d0}$); the gain in producer surplus ($P_{s0}CEP_{s1}$); and the loss in government expenditures on the subsidy ($P_{d0}BCP_{s0}$- $P_{d1}FEP_{s1}$).

In the following six sections, we apply the methodology that has been outlined above for estimating the economic prices for nontradable goods and services under different types and combinations of distortions while illustrating each case with a numerical example. The procedure is to start with relatively straightforward cases for which economic prices and conversion factors can be easily estimated. For the more complicated situations that ensue, the methodology outlined below allows one to estimate the economic prices and conversion factors for nontradable goods and services. However, these more sophisticated cases also have more demanding information requirements.

The analyses presented here are carried out under the assumption that despite the distortions that might exist in the form of taxes and subsidies, or that can be expressed as a tax or a subsidy in the markets for these nontradable goods or services, there are no quantitative restrictions on the demand for or supply of these goods or services.[36]

The estimated economic prices are expressed in terms of domestic currency.

Case 1: A Project Producing A Nontradable Output with:

- No distortions in the market for that output;
- No distortions in any of the factors, substitutes or complements of the output; and where
- All inputs used in the production of the project's output are nontradable.

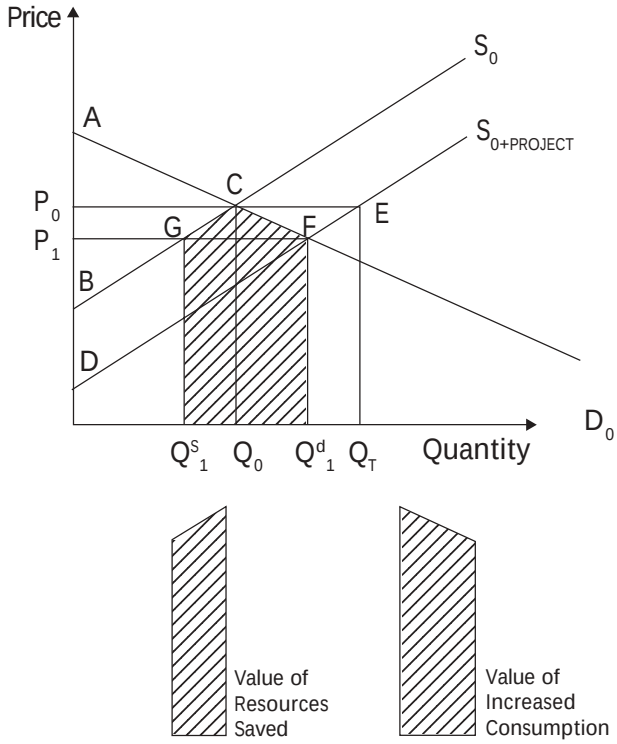
When a project produces a nontradable output in a market where prices are competitively set, the price of the output will, in general, drop due to the additional supply of the project. At the new prices, the existing producers of the good are not willing to supply the same quantity of the good as before. As a result, they will cut back their production releasing resources for alternative uses in the economy. At the same time, the lower prices will induce additional consumption by the demanders of this good or service.

If there are no distortions in the markets of the substitutes or complements for a nontradable output produced by a project, and if all the inputs used in its production are nontradable and their markets are undistorted, the gross economic benefit (economic price) of the output will be the sum of the value of the released resources (as measured by the competitive supply curve — area $Q^s_1GCQ_0$ in Figure 11.5 and the value to the demanders of the additional consumption as measured by their willingness to pay — area $Q_0CFQ^d_1$. In other words, the economic price per unit of the good or service produced will be a weighted average of the supply price per unit (P^s) and the demand price per unit (P^d).

The supply price per unit (P^s) is the average of the supply price before the implementation of the project (P^s_0), and the supply price after the project

[36] For the evaluation of economic prices under conditions of rationing, price ceilings and monopoly, see Jenkins, Glenn P. and Arnold C. Harberger, Manual for Cost-Benefit Analysis of Investment Decisions, unpublished, (2005) pp. 9.14-9.24.

Figure 11.5: Economic Benefits of Project Output (No Distortions)



(P^s_1). Similarly, the demand price per unit is the average of the demand price before (P^d_0) and after (P^d_1) the implementation of the project.

The weighting reflects the responsiveness of consumers and suppliers to changes in prices of the nontradable output. The weight applied to the demand side is the expected increase in the total consumption of the good or service, as a result of introducing the project's output, expressed as a proportion (W^d) of the project's sales. Similarly, the weight applied to the supply side is the decrease in the supply by nonproject producers expressed as a proportion (W^s) of the project's sales. The sum of these weights must add up to one. To put it differently, it is necessary to determine what proportion of the quantity produced by the project replaces the cutback in the production of the existing (nonproject) suppliers and what proportion of the project output adds to the existing supply in the market. Although the responsiveness and the relative weights can be formally calculated using elasticities, approximate values for these relative weights are usually arrived at by applying practical knowledge of the nature of demand and supply in the market.[37]

If it is anticipated that a drop in the output price will lead to an increase in the quantity demanded that is roughly equal to the cutback in the quantity supplied, then the weights can be considered approximately equal ($W^s = W^d = 0.5$). Alternatively, if it is anticipated that the supply response will be approximately twice the demand response, then the weight on the supply side of the market (W^s) will be equal to 0.67 and that on the demand side of the market (W^d) will be equal to 0.33.

The examples used throughout this Part will demonstrate how the relative weights can be chosen for different goods and services. For practical purposes, one can limit the choices available to the following proportions:

1) $W^s = 0.67$ and $W^d = 0.33$
2) $W^s = 0.50$ and $W^d = 0.50$
3) $W^s = 0.33$ and $W^d = 0.67$

[37] The weight on supply (W^s) = $\varepsilon^s / (\varepsilon^s - \eta^d * (Q^d/Q^s))$, and the weight on demand (W^d) = $-(\eta^d * (Q^d/Q^s)) / (\varepsilon^s - \eta^d * (Q^d/Q^s))$
where: ε^s = the price elasticity of supply
η^d = the price elasticity of demand
Q^d = the responsive quantity demanded in the market without the introduction of the project
Q^s = the responsive quantity supplied in the market without the introduction of the project

As subjective as the choice of these weights might seem, the estimation of economic prices using these weights tends to improve the accuracy of measuring economic values as compared to traditional approaches which place all the weight for adjustment on either the demand- or the supply-side of the market.

Estimation of Economic Prices

Algebraically, the economic price per unit of a nontradable output produced by a project and expressed in the domestic currency (P^e) is represented as follows:

$$P^e = W^d * P^d + W^s * P^s$$

where, $W^d + W^s = 1$

When no distortions apply to the market of a nontradable goods, the demand (P^d) and supply price (P^s) are both equal to the market price (P^m). In this case, if all inputs used in the production of that good have no tradable content, the estimation of the relative supply and demand weights is unimportant as the economic price per unit (P^e) is equal to the market price (P^m).

After estimating the economic price of the output, a commodity-specific conversion factor (CSCF) can be obtained by dividing the economic value per unit of output by its financial value:

$CSCF^s$ = Economic price per unit / Financial price per unit

This conversion factor will capture the degree of deviation between the financial supply price of the good and its economic price. One of the advantages of estimating commodity-specific conversion factors is their possible application to other projects producing the same output.

CSCFs = Economic price per unit / Financial price per unit. This conversion factor will capture the degree of deviation between the financial supply price of the good and its economic price. One of the advantages of estimating commodity-specific conversion factors is their possible application to other projects producing the same output.

Illustrative Example 1: A Project Providing Camp Site Nights

Consider the competitive market for camp sites in a beach resort where the quantities demanded and supplied are measured in terms of camp site nights per year. At present, and in the absence of distortions, the quantity supplied and demanded is 30,000 camp site nights per year at a price of 50 rupees per night. Now introduce a project that will provide 2,000 camp site nights per year, and assume that the impact of the project output on the competitive market price is small.

Let P^s = the supply price per camp site night,
P^d = the demand price per camp site night,
P^m = the market price per camp site night,

Note that $P^s = P^d = P^m = 50$ rupees.

Now consider the estimation of the economic price per camp site night in domestic currency generated by the project.

As the inputs used for the production of camp site nights are largely nontradable (land and labor), the economic price per unit expressed at

the domestic price level (P^e) is calculated as:

$$P^e = W^d * P^d + W^s * P^s$$

Since the demand price (P^d) equals the supply price (P^s) and each is equal to 50 rupees,[38] there will be no need to estimate the relative demand and supply weights; and the economic benefit per camp site night will be equal to 50 rupees. Stated differently, the proportion of the project's sales that will be a mere replacement of the output of the nonproject producers has a value of 50 rupees per camp site night as does the proportion of project's sales that will lead to increased consumption by the demanders of the good.

The commodity-specific conversion factor for camp site nights at the domestic price level ($CSCF^s$) will be equal to one as the economic price per camp night (50 rupees) is equal to its financial price (50 rupees).

Case 2: A Project Producing a Nontradable Output Where:

- Distortions exist in the market for that output;
- No distortions in factor, substitute or complement markets; and
- Inputs used for the production of the project's output have tradable goods component.

The framework of analysis here is similar to that used earlier to estimate the economic price of a nontradable output in the absence of distortions in the output market as well as in its factor, substitute and complement markets. The additional supply by the project will drive the market price of the output down, and will lead to a cutback in production by existing producers and an increase in consumption by demanders.

When there is a distortion in the market for the nontradable output of a project, the distortion drives a wedge between the demand price, P^d, and the supply price, P^s. Figure 11.6 illustrates the effect of a project on P^d and P^s when the project's output is subject to a sales tax. P^d_0 and P^s_0 are prices without the project; P^d_1 and P^s_1 are prices with the project. The gross economic benefit (economic price) of the output will be the sum of the value of the released resources as measured by the supply curve of the nonproject producers — area $Q^s_1ABQ_0$ in Figure 11.6 — and the value to the demanders of the additional consumption as measured by their willingness to pay — area $Q_0DEQ^d_1$ in Figure 11.6. What the demanders pay consists of payments to suppliers (area $Q_0FCQ^d_1$) and taxes to government (area FGEC).

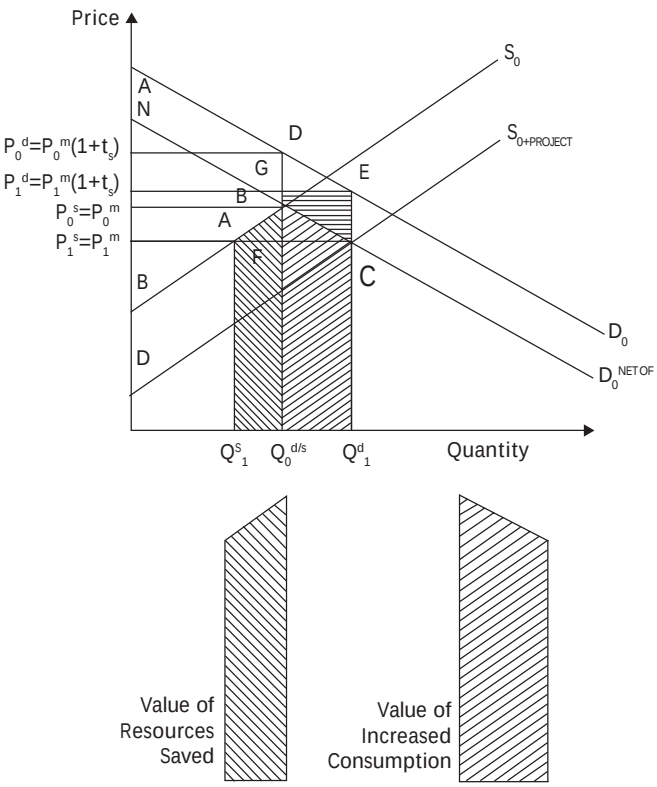
Suppliers would receive $Q_0BCQ^d_1$ only if they could perfectly price discriminate along the demand curve, which is not possible in a competitive market. However, as long as the project's output is small relative to the initial market, $Q_0FCQ^d_1 \approx Q_0BCQ^d_1$ and FGEC ≈ BDEC.

Economic Price of a Nontradable Output with Adjustment for the Foreign Exchange Premium

In the previous case, the economic price per unit was estimated as a weighted average of the

[38] If the quantity produced by the project is relatively large compared to the total output of the market, it will lead to a drop in the market price of camp site nights. When estimating the economic price per camp site night in such a case, we use the average of the prices without (before) the project and those with (after) the project.

Figure 11.6: Economic Benefits of Project (Tax on Output)



value of the resources saved as measured by the supply price and value of the additional consumption as measured by the demand price. In that situation, it was assumed there were no distortions in the markets for the factors used to produce the nontradable output and that they were all nontradable goods. In addition, it was assumed that there were no distortions in the markets for the output's complements and substitutes.

The supply price used to estimate the value of the saved resources is based on the financial prices of the inputs utilized in the production of the nontradable output. If all of these inputs are nontradable goods and there are no distortions in their competitive markets, the supply price

When a project purchases a nontradable input in a market where prices are competitively set, the price of the input will in general be bid up due to the additional demand. As the price of the nontradable input increases, consumers will reduce their purchases of the input, and at the same time, the higher prices will provide an incentive for suppliers of the input to expand production.

will reflect the true economic cost to society of the resources saved.

If there are no distortions in the markets for the inputs used in the production of a nontradable output but some of these inputs are tradable goods, then the supply price of the output will need to be adjusted to reflect the true economic cost of its tradable components. In this case, the economic benefit per unit of output produced, expressed at the domestic currency, will have two main components. The first one is a weighted average of the value of the released (saved) resources measured by the competitive supply price and the value of the additional consumption measured by the competitive demand price. The second component is the premium on the foreign exchange applicable to the tradable inputs that are now saved as the nonproject suppliers to the market reduce their production of nontradable output.

Combining both components, the economic price per unit of nontradable output expressed in the domestic currency (P^e) is calculated as follows:

$$P^e = W^d_x * P^d_x + W^s_x * P^s_x + W^s_x * \left(\sum_{i=1}^{n} A_{xi} * P^d_i\right) * (E^e/OER - 1)$$

where, $W^d + W^s = 1$

x = output produced by the project
P^d_x = demand price per unit of output
P^s_x = supply price per unit of x
P^d_i = demand price per unit of input i
A_{xi} = input-output coefficient showing the quantity of input i used in the production of one unit of x
E^e = economic exchange rate
OER = official or market exchange rate

The first part, on the right hand side of the equation, is the weighted average of the competitive demand and supply prices. The second part reflects the adjustment for the foreign exchange premium associated with the tradable components of the inputs used in the production of the nontradable output. This term will be positive, indicating greater benefits to society, if the economic value of foreign exchange is larger than its market value. In this case, the economic value of the resources saved is greater than their financial (supply) value.

To estimate the undistorted tradable input component used in the production of a nontradable output of a project when there are no distortions in the markets for the factors, one starts by breaking down the inputs used for the production of the output into both tradable and nontradable components. The nontradable components can be further broken down into their tradable and nontradable elements. The financial values of all the tradable components are then added and expressed as a percentage (%T) of the supply price of the nontradable output in question. Although the process of breaking down the nontradable components into their tradable and nontradable parts could be continued for several stages, it is customary to stop after one or two rounds as this will usually yield an acceptable degree of accuracy.

Note that the adjustment for the tradable component pertains only to the proportion of the project's sales (W^s) that replaces some of the resources of existing (nonproject) producers. Hence, the adjustment is only applied to the supply-side of the market.

In the presence of distortions in the market for a nontradable output produced by a project, the estimation of the economic price per unit of output will require the determination of the following: (i) the supply price (P^s), (ii) the demand price (P^d), (iii) the relative weights of demand and supply (W^d and W^s) and (iv) the proportion (%T) of the undistorted tradable goods component in the output. Taxes levied on the market price (P^m) at the retail level will cause the demand price to be higher than the market price: [$P^d = P^m * (1 + \text{tax rate})$]. Production subsidies given on the total resources spent would cause the supply price to be higher than the market price: [$P^s = P^m/(1 - \text{subsidy rate})$]; while taxes levied at the producers level will cause the supply price to be lower than the market price. Table 11.1 gives the relationship between supply, demand and market prices under various types of distortions.

After estimating the economic price of the output, a commodity-specific conversion factor (CSCF) can be obtained by dividing the economic value per unit of output by its financial value:

$CSCF^s$ = Economic price per unit / Financial (supply) price per unit

Illustrative Example 2: A Project Providing Hotel Room Nights

Consider the competitive market for hotel rooms in a beach resort where the quantities

Table 11.1: Relationship between Market Prices and Demand and Supply Prices with Various Types of Distortions[39]

Case	Type of Tax or Subsidy	Supply Price	Demand Price
1	Percentage Sales Tax (t_s) Levied on Market Price at Retail Level	$P^s = P^m$	$P^d = P^m(1+ t_s)$
2	Unit Sales Tax of T_s Levied on Market Price at Retail Level	$P^s = P^m$	$P^d = P^m + T_s$
3	Percentage Subsidy K Given on Total Resources Spent on Production	$P^s = P^m/(1-K)$	$P^d = P^m$
4	Unit Subsidy K_u Given per Unit Output Produced	$P^s = P^m + K_u$	$P^d = P^m$
5	Percentage Tax (t_p) Levied at Producers Level	$P^s = P^m/(1+t_p)$	$P^d = P^m$
6	Unit Tax (T_p) Levied at Producers Level	$P^s = P^m - T_p$	$P^d = P^m$
7	Two Percentage Taxes t_1 and t_2 Levied on Output at Retail Level, (compounded)	$P^s = P^m$	$P^d = [P^m(1+t_1) * (1+ t_2)]$

demanded and supplied are measured in terms of hotel-room nights per year. At present, there is a 25 percent sales tax (t_s) levied on the market price of room nights and the competitive quantity demanded and supplied is 60,000 room nights at a market price (P^m) of 800 rupees per night. Now introduce a project that will provide 4,000 room nights per year. Assume that the impact of the project output on the competitive market price is small and that the proportion of the undistorted tradable goods component (%T) that is used in the production of hotel room nights is estimated to be 60 percent of the supply price (P^s). The official exchange rate (OER) is 45 rupees per US rupee and the economic exchange rate (E^e) is 50 rupees per rupee.

Let P^s = the supply price per room night;
P^d = the demand price per room night; and
P^m = the market price per room night.

Consider the estimation of the economic benefit per room night generated by the project.

Estimation of the Economic Price of Hotel Room Nights in Domestic Currency:

(The figures in this example are assumed for illustrative purposes only)

The estimation of the economic price of hotel room nights involves the following three initial steps:

Step 1: Estimate the demand price

$$P^d = P^m * (1 + t_s) = 800 * (1.25) = 1000 \text{ rupees}$$

Step 2: Estimate the supply price

$$P^s = P^m = 800 \text{ rupees}$$

Step 3: Estimate the supply and demand weights (W^s and W^d)

For a hotel in a beach resort, one would expect consumers to be considerably more responsive than suppliers to changes in room rates. As this type of recreation is by no means a necessity,

[39] Harberger, A.C. and Jenkins, G.P., "Manual for Cost Benefit Analysis of Investment Decisions," Unpublished, (2005) Chapter 9.

one would have reason to believe that consumers are highly sensitive to price changes. In addition, the existence of other beach resorts as well as other competing types of recreation, will provide consumers with a relatively large menu of choices. Suppliers of such facilities, on the other hand, do not have the same range of options to reemploy their resources. Hence, it would seem reasonable to assign a higher weight to the demand-side response of the market than to its supply side response. It may therefore be appropriate to use $W^d = 0.67$ and $W^s = 0.33$.

Now substituting into equation, the economic price per unit expressed in domestic currency:

$$(P^e) = W^d * P^d + W^s * P^s + W^s * \%T * P^s * (E^e/OER - 1)$$
$$= 0.67 * 1000 + 0.33 * 800 + 0.33 * 0.60 * 800 * (50/45 - 1)$$
$$= 951.6 \text{ rupees}$$

Note that the value of the foreign exchange adjustment of the undistorted tradable component of the nontradable output (the third part on the right hand side of the equation) is 17.6 rupees per unit, a value less than 2 percent of the economic price per hotel night produced by the project. If a crude estimation of the undistorted tradable goods component (%T) of hotel room nights had yielded a result of 40 percent instead of the actual 60 percent, the economic price per hotel room night would have come out to 945.7 rupees instead of 951.6 rupees, a difference of less than 1 percent of the economic price per night. The value of the foreign exchange adjustment in the above equation will be smaller, the smaller the supply weight (W^s), the undistorted tradable goods component (%T) of the nontradable output and the difference between the official exchange rate and the economic exchange rate.

The commodity-specific conversion factor ($CSCF^s$) for hotel room nights in this resort is given by:

$$CSCF^s = P^e/P^s$$
$$= 951.6/800$$
$$= 1.189$$

Case 3: A Project Using a Nontradable Intermediate Goods Where:

- Distortions exist in the market for that intermediate goods;
- No distortions exist in its factor, substitute or complement markets; and
- Inputs used for the production of that intermediate goods have tradable component.

When a project purchases a nontradable input in a market where prices are competitively set, the price of the input will in general be bid up due to the additional demand. As the price of the nontradable input increases, consumers will reduce their purchases of the input, and at the same time, the higher prices will provide an incentive for suppliers of the input to expand production.

Estimation of the Economic Price of an Intermediate Goods used as an Input of a Project

In the absence of distortions in the factor markets of an intermediate goods and in the markets for its complements and substitutes, and if all inputs used in the production of the nontradable goods are also nontradable, then

the economic cost of the input used by the project is a weighted average of the value of the additional supply (as measured by the supply curve) and the value of the consumption given up by demanders (as measured by the demand curve). However, if some of the inputs used in the production of the nontradable intermediate goods are tradable goods, then the supply price will need to be adjusted to reflect the economic cost of the tradable components.[40]

The economic price per unit of intermediate goods purchased expressed in domestic currency (P^e), can be broken down into two main parts: the first, is a weighted average of the value of the resources used in the production of the additional supply as measured by the competitive supply price and the value of the consumption given up by the demanders as measured by the competitive demand price. The second part is the premium on the foreign exchange spent on the tradable inputs used in the increased production of the nontradable intermediate goods.

Combining both parts, the economic price per unit of nontradable input used by the project and expressed at the domestic price level (P^e) is calculated as follows:

$$P^e = W^d_x * P^d_x + W^s_x * P^s_x + W^s_x * \%T * P^s_x * (E^e/OER - 1)$$

where, $W^s_x + W^d_x = 1$

x = intermediate goods purchased by the project

%T = undistorted tradable goods component of the nontradable intermediate goods used by the project expressed as a % of the financial supply price of the intermediate goods

E^e = economic exchange rate

OER = official or market exchange rate

The first two terms on the right hand side of the equation yield the weighted average of the demand and supply prices. The last term reflects the adjustment for the foreign exchange premium attached to the undistorted tradable components of the inputs used in the production of the nontradable intermediate goods. This part will be positive, indicating a greater cost to society, if the economic value of the foreign exchange is larger than its market value, i.e., the economic value of the tradable inputs is greater than their financial value. Note that the adjustment for the tradable component pertains only to the proportion of the project's demand for the intermediate goods (W^s) that is met through additional production. The proportion of the project's demand that is accommodated through a reduction in the purchases of other consumers (W^d) should not be adjusted to reflect the distortions in the input markets. Since the production of this proportion will be carried out regardless of whether the project is undertaken, the adjustment is applied to only the additional supply to this market.

In the presence of distortions in the market for an intermediate goods, the estimation of the economic price (P^e) of the good will also require the determination of the following: (i) the intermediate input's supply price (P^s); (ii) its demand price (P^d); (iii) the relative weights of demand and supply (W^d and W^s); and (iv) the

[40] The nature and mechanics of the adjustment are explained in detail in an earlier section where we estimate the economic price of a nontradable output produced by a project when some of the inputs used in the production of the output are tradable goods.

proportion (%T) of the undistorted tradable goods component in the costs of production of the intermediate input.

After the estimation of the economic price of the intermediate input, a commodity-specific conversion factor ($CSCF^d$) based on the financial demand price of the input can be calculated as follows:

$CSCF^d$ = Economic price per unit / Financial (demand) price per unit

Illustrative Example 3: A project using bricks as an input

Consider the competitive market for clay bricks where at present, there is a 25 percent sales tax (t_s) on the market price of bricks and a 15 percent subsidy (K) on the suppliers' cost of production. The quantity demanded and supplied in the market is 7 million bricks per month at a market price (P^m) of 7 rupees per brick. Now, we introduce a project to construct low-cost housing. During the later stages of the construction, it is expected that the project will require 300,000 bricks per month. Assume that the impact of the project demand on the competitive market price is small and that the proportion of the undistorted tradable goods component (%T) used in the production of bricks is estimated to be 70 percent of the supply price (P^s). The official exchange rate (OER) is 45 rupees per US rupee and the economic exchange rate (E^e) is 50 rupees per rupee.

Let

P^s = the supply price per brick;
P^d = the demand price per brick; and
P^m = the market price per brick.

Consider the estimation of the economic cost of bricks in domestic currency used by this project.

Illustration: Estimation of the Economic Price of Bricks

(The figures in this example are assumed for illustrative purposes only)

Step 1: Estimate the demand price

$P^d_x = P^m_x * (1 + t_s)$
$= 7 * (1.25)$
$= 8.75$ rupees

Step 2: Estimate the supply price

$P^s_x = P^m_x/(1 - K)$
$= 7/(0.85)$
$= 8.24$ rupees

Step 3: Estimate the supply and demand weights

For such production activity, the expected supply response will be small in the short run as most brick making kilns are usually operating close to capacity.[41] Although the supply response will be larger in the longer run, it will still not be as large as the demand response. In other words, a larger proportion of the bricks required by the project will be obtained by existing demanders' postponing their consumption, rather than from new production. Hence, assigning a weight of 0.67 to the demand-side and a weight of 0.33 to the supply-side seems plausible.

Now, substituting the economic cost per brick at the domestic price level (P^e)

$= W^d * P^d + W^s * P^s + W^s * \%T * P^s * (E^e/OER - 1)$
$= 0.67 * 8.75 + 0.33 * 8.24 + 0.33 * 0.7 * 8.24 * (50/40 - 1)$

[41] In the case of existing excess capacity, more weight should be assigned to the supply side. As the situation of excess capacity will likely be temporary, however, no generalizations can be made about the economic cost or the conversion factor of this nontradable input.

= 8.79 rupees

If the value of the foreign exchange adjustment for the tradable component of the intermediate goods used by the project were to be ignored, the economic cost per brick would be 8.58 rupees per unit. In other words, the economic cost would be underestimated by approximately 2 percent of the true economic cost per brick.[42]

The commodity-specific conversion factor ($CSCF^d$) for bricks used by this project is given by:[43]

$$CSCF^d = P^e/P^d$$
$$= 8.79/8.75$$
$$= 1.0045$$

Case 4: A Project Using a Nontradable Intermediate Goods as an Input Where:

- Distortions exist in the market for that intermediate goods;
- Distortions exist in its factor markets;
- No distortions in its substitute or complement markets; and
- Inputs used in the production of the intermediate goods have tradable goods component.

In the previous Section, a framework was established for estimating the economic cost of a nontradable intermediate goods where only the market for that goods was distorted. In other words, it was assumed that the financial prices of the inputs used in the production of the intermediate goods reflected their economic values. This section outlines a framework for estimating the economic cost of an intermediate goods when there are distortions in both the market for the intermediate goods and in its factor markets.

Estimation of the economic price of an intermediate goods with distortions in both the market for the intermediate goods and its factor markets.

When distortions exist in the market for an intermediate goods, but in none of the markets for its factors, substitutes or complements, the economic cost per unit of that intermediate goods (P^e) is calculated as a weighted average of the supply price (P^s) and the demand price (P^d), plus an adjustment for the foreign exchange premium on the tradable components used in the production of intermediate goods.

$$P^e = W^d_x * P^d_x + W^s_x * P^s_x + W^s_x * \%T * P^s_x * (E^e/OER - 1)$$

However, if distortions also exist in the factor markets, an adjustment to the above equation is required when estimating the economic cost of the intermediate goods. If, in the production of intermediate goods x, only input i is distorted, then the economic cost per unit of the intermediate goods used by the project (P^e) is

[42] The value of the foreign exchange adjustment to the undistorted tradable component of the intermediate goods used by the project is calculated as follows:

$$= W^s * \%T * P^s * (E^e/OER - 1)$$
$$= 0.33 * 0.7 * 8.24 * (50/45 - 1)$$
$$= 0.21 \text{ rupees per brick}$$

[43] Since the project uses bricks as an input, the relevant financial price in the estimation of the commodity-specific conversion factor is the demand price inclusive of the 25 percent sales tax.

estimated as follows:

$$P^e = W^d_x * P^d_x + W^s_x * P^s_x + W^s_x * \%T * P^s_x * (E^e/OER - 1) - W^s_x * A_{xi} * (P^d_i - P^e_i)$$

where,

- x = intermediate goods demanded by the project
- A_{xi} = input-output coefficient showing the quantity of input i used in the production of one unit of x
- $\%T$ = undistorted tradable goods component of the intermediate input x expressed as a percentage of the financial supply price of x
- P^d_x = demand price per unit of x
- P^s_x = supply price per unit of x
- P^d_i = demand price per unit of input i
- P^e_i = economic value per unit of input i expressed in domestic currency

In the case where a value added tax (VAT) is levied on both an intermediate goods and its inputs, the VAT on the inputs is not recognized as a tax because such input taxes are allowed as a credit against the VAT on the intermediate goods. If the intermediate goods is exempt from VAT, the tax on the inputs is treated like a sales tax because no credit is possible at the intermediate goods level. If less than full credit is given for the input taxes, then the excess is treated as an input tax. Where the credit given at the intermediate goods level is greater than the underlying taxes paid on the inputs, the excess credit is treated as a subsidy on the purchase of the intermediate input.

Note, that any adjustments for the intermediate goods x are weighted by W^s_x, the share of the project's demand for the intermediate goods x that is met by increased supply. This adjustment for input distortions only applies to the additional inputs utilized because of the increased production. The proportion of the project's demand that is met through a cutback in the demand of other consumers, W^d_x, is valued at the demand price P^d_x and should not be adjusted to reflect the distortions in the input markets. This is due to the fact that these inputs will be used in the production of this intermediate goods x whether or not the project being considered is implemented.

When several inputs used in the production of the intermediate goods x have distortions in their markets, a more general form can be used:

$$P^e = W^d_x * P^d_x + W^s_x * P^s_x + W^s_x * \%T * P^s_x * (E^e/OER - 1)$$

$$- W^s_x * \sum_{i=1}^{n} A_{xi} * (P^d_i - P^e_i)$$

In the absence of distortions in the factor markets, the data required to estimate the economic cost of an intermediate goods x are the supply and demand prices for the good, its relative demand and supply weights and its undistorted tradable goods component (%T). With distortions in the factor markets, three additional pieces of information are required for each distorted input i: (i) its input-output coefficient (A_{xi}), (ii) its demand price (P^d_i) and (iii) its economic price (P^e_i).

If the commodity-specific conversion factors ($CSCF^d_i$) are known for all inputs that have distortions in their markets and that are considered in the estimation of the economic cost of the intermediate goods (P^e_x) the

following alternative representation of equation can be used:[44]

The process of adjusting the economic cost of intermediate goods for differences between the financial (demand) prices and the economic prices of their inputs could be iterated back through several stages of production. However, correcting for the distortions in the market for an intermediate goods and its factor markets, will generally yield an acceptable degree of accuracy.

After the estimation of the economic price of an intermediate goods x, its commodity-specific conversion factor ($CSCF^d_x$) can be calculated as follows:

$CSCF^d_x$ = Economic Price per unit / Financial (demand) Price per unit

Specifically,

$$CSCF^d_x = [W^d_x * P^d_x + W^s_x * P^s_x + W^s_x * \%T * P^s_x * (E^e/OER - 1) - W^s_x * \sum_{i=1}^{n} \{A_{xi} * (1 - CSCF^d_i) * P^d_i\}] / P^d_x$$

If there are taxes on the sale of the intermediate goods and subsidies on its resource cost, we can incorporate these, as well. Since:

$P^s_x = P^m/(1 - k)$ and $P^d_x = P^m * (1 + tax)$

Then, $P^s_x = P^d_x/[(1+tax)*(1-k)]$

Therefore,

$$CSCF^d_x = [W^d_x * P^d_x + W^s_x * P^d_x/((1+tax)*(1-k)) + W^s_x * \%T * P^d_x/((1+tax) * (1-k)) * (E^e/OER-1) - W^s_x * \sum_{i=1}^{n} A_{xi} * (1 - CSCF^d_i) * P^d_i] / P^d_x$$

Note, that if the cost proportions of inputs C_i are known, but the input-output coefficients are not, we can substitute for A_{xi}:

$A_{xi} = C_i * (P^s/P^d_i)$.

Simplifying at the same time, we have:

$$CSCF^d_x = W^d_x + W^s_x * (1/ (1+tax)*(1-k)) * [\{1 + \%T * (E^e/OER-1)\} - \sum_{i=1}^{n} C_i * (1 - CSCF^d_i)]$$

Illustrative Example 4: A project using bricks as an input when there are distortions in the markets of clay and furnace oil (two of the inputs used in brick production)

(The figures in this example are assumed for illustrative purposes only)

Consider the competitive market for clay bricks where a 25 percent sales tax (t_s) is levied on the market price of bricks and a 15 percent subsidy (K) is set on the supplier's cost of production. Without the project, the quantity demanded and supplied in the market is 7 million bricks per month at a market price (P^m_x) of 7 rupees per

[44] Since the supply price of an intermediate goods x is based on the financial demand prices of all inputs used in its production, one should use the demand price to estimate the commodity-specific conversion factor ($CSCF^d$) for each of the inputs. Note that the commodity-specific conversion factor calculated on the basis of the demand price could be represented in terms of the commodity-specific conversion factor calculated on the basis of the supply price (CSCFs) as follows:

$CSCF^d = CSCF^s * (P^s/P^d)$.

See Asian Development Bank, Economics Office, "Guidelines For Economic Analysis of Projects" (1987) page 93.

brick. Now introduce a project that requires 300,000 bricks per month and assume that the impact of the project demand on the competitive market price for bricks is small.

Two of the inputs used in the production of bricks have distortions in their markets: (i) Clay, a nontradable goods with no tradable components, has a 20 percent sales tax (t_s) levied on its market price (P^m_c) of 250 rupees per ton;[45] (ii) Furnace oil, an importable good, has a subsidy (K_{oil}) of 50 percent on its CIF price of USD 240 per ton. The input-output coefficient for furnace oil (A_{xoil}) is 180 kilograms of oil per 1000 bricks and that of clay (A_{xc}) is 3.5 tons of clay per 1000 bricks. The undistorted tradable goods component (%T) of bricks is estimated to be 55 percent of the supply price of bricks. The official exchange rate (OER) is 45 rupees per US rupee and the economic exchange rate (E^e) is 50 rupees per rupee.

Let: x : the intermediate goods demanded by the project (bricks)
- P^s_x : the supply price per brick
- P^d_x : the demand price per brick
- P^m_x : the market price per brick
- A_{xi} : the input-output coefficient indicating the use of input i in the production of x
- P^s_i : the supply price per unit of input i
- P^d_i : the demand price per unit of input i
- P^e_i : the economic value per unit of input i expressed in domestic prices
- c : clay

Now, consider the estimation of the economic cost per brick used by this project.

Estimation of the Economic Price of Bricks in Domestic Currency (Adjusting for Distortions in Markets of Clay and Oil):

The economic cost per brick (P^e_x) is estimated using equation:

$$P^e_x = W^d_x * P^d_x + W^s_x * P^s_x + W^s_x * \%T * P^s_x * (E^e/OER - 1) - W^s_x * \{A_{xc} * (P^d_c - P^e_c) + A_{xoil} * (P^d_{oil} - P^e_{oil})\}$$

The first four terms on the right hand side of the equation have been previously determined and have the following values:

$W^s_x = 0.33$, $P^s_x = 8.24$ rupees, $W^d_x = 0.67$
$P^d_x = 8.75$ rupees

As the values of the foreign exchange premium, the input-output coefficients for clay and oil, and the undistorted tradable goods content are known, it only remains to estimate the economic prices and the financial demand prices for the two inputs. The estimation of the economic price of clay will be carried out according to the procedure detailed for nontraded goods and will first require the determination of both the supply price and the relative supply and demand weights for clay.

1. Clay

Step 1: Estimating the demand price

$$P^d_c = P^m_c * (1 + t_s) = 250 * (1.2) = 300 \text{ rupees per ton}$$

[45] It is being assumed that the change in the market price of clay on account of the project's demand is relatively small, hence justifying the use of without the project prices, rather than an average of the prices with and without the project.

Step 2: Estimating the supply price

$P^s_c = P^m_c$

$= 250$ rupees per ton

Step 3: Estimating the supply and demand weights

If clay is not in short supply, one can reasonably assert that the demand for clay derived from the project's demand for bricks will be mostly met from additional supply. Accordingly, a demand weight (W^d_c) of 0.33 and a supply weight (W^s_c) of 0.67 are assigned.

The economic cost of clay[46]

$(P^e_c) = W^d_c * P^d_c + W^s_c * P^s_c$

$= 0.33 * 300 + 0.67 * 250$

$= 266.5$ rupees per ton.

$CSCF^d_c$ = Economic price / Financial (demand) price

$= 266.5/300$

$= 0.888$

2. Furnace Oil

Step 1: Estimating the demand price

$P^d_{oil} = \text{CIF price} * \text{OER} * (1 - K_{oil})$

$= 240 * 45 * (1 - 0.5)$

$= 5{,}400$ rupees per ton

Step 2: The economic cost of furnace oil

$(P^e_{oil}) = \text{CIF price} * E^e$

$= 240 * 50$

$= 12{,}000$ rupees per ton

$CSCF^d_{oil}$ = Economic price / Financial (demand) price

$= 12{,}000/5{,}400$

$= 2.22$

Now, that the estimation of the economic costs of the two inputs is completed, the economic cost per brick (P^e_x) at the domestic price level can be calculated as follows:

$$P^e_x = W^d_x * P^d_x + W^s_x * P^s_x + W^s_x * \%T * P^s_x * (E^e/OER - 1) - W^s_x * \{A_{xc} * (P^d_c - P^e_c) + A_{xoil} * (P^d_{oil} - P^e_{oil})$$

$$= 0.67*8.75 + 0.33*8.24 + 0.33*0.55*8.24*(50/45 - 1) - 0.33*\{0.0035*(300 - 266.5) + (18*10^{-5})*(5400 - 12000)\}$$

$= 9.17$ rupees per brick

In the absence of distortions from the markets of the inputs used in the production of bricks, the economic cost per brick was calculated earlier to be 8.79 rupees. The divergence between this value and the one just estimated (with distortions in the factor markets) is primarily due to the highly subsidized furnace oil. While the net loss to the government due to the subsidy on fuel is 392 rupees per 1000 bricks used,[47] the effects of the distortions in the clay market on the economic price of bricks are far more negligible.

If the commodity-specific conversion factors ($CSCF^d_i$) for clay and furnace oil are known, then

[46] Clay has no tradable content and hence, does not require any foreign exchange adjustment.

[47] This is calculated as follows: $- W^s_x * A_{xoil} * (P^d_{oil} - P^e_{oil})$

$= - 0.33*(18*10^{-5})*(5400 - 12000)$

$= 0.392$ rupees per brick

the economic cost per brick at the domestic price level (P^e_x) can be calculated as follows:

$$
\begin{aligned}
P^e_x &= W^d_x * P^d_x + W^s_x * P^s_x + W^s_x * \%T * P^s_x * (E^e/OER - 1) - W^s_x * \{A_{xc} * (1 - CSCF^d_c) * P^d_c + A_{xoil} * (1 - CSCF^d_{oil}) * P^d_{oil}\} \\
&= 0.33*8.24 + 0.67*8.75 + 0.33*0.55*8.24*(50/45 - 1) - 0.33*\{0.0035*(1 - 0.888)*300 + (18*10^{-5})*(1 - 2.3)*5400\} \\
&= 9.17 \text{ rupees per brick.}
\end{aligned}
$$

The commodity-specific conversion factor ($CSCF^d_x$) for bricks purchased by the project is calculated as follows:

$$
\begin{aligned}
CSCF^d_x &= P^e_x/P^d_x \\
&= 9.17/8.75 \\
&= 1.048
\end{aligned}
$$

Part 12: Estimation of Economic Prices for Goods and Services in Regulated Markets

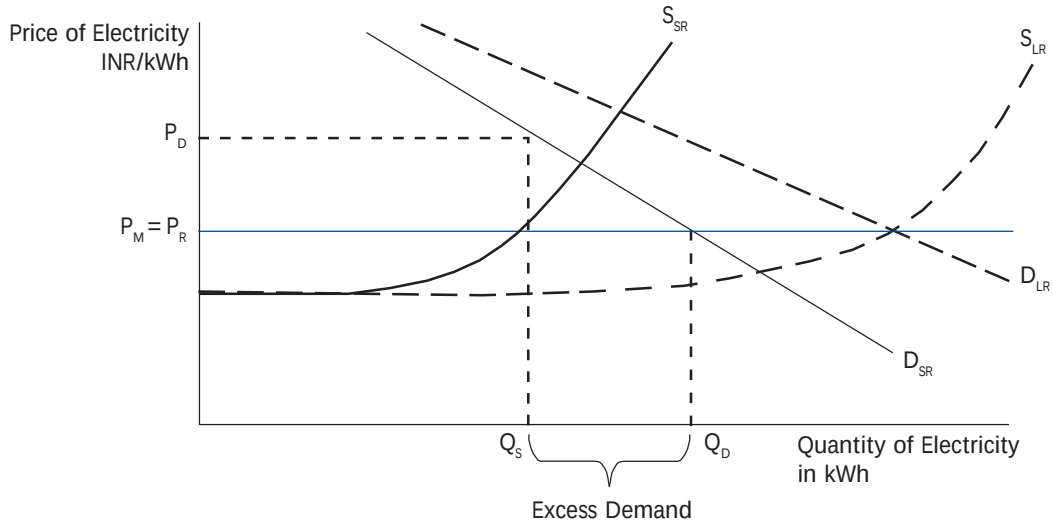
Introduction

The third category of goods for which a methodology for estimating economic prices is required is goods and services traded in regulated markets. These are typically nontraded public services or utilities where the price is set by the government or by some regulatory authority. Typical examples are the supply of water or electricity services. In these markets, it is generally the case that the market price is not allowed to respond flexibly with changes in market demand or supply. As a result, imbalances can exist that require additional allocation mechanisms to balance the markets. For example, some rationing mechanism may be used to allocate goods in a market with a shortage of supply. How a market is brought to equilibrium affects how added supply from a project is absorbed by the market, or how added project demand is sourced from the market, and hence, how its economic value is determined.

The case of electricity is used to illustrate the method of valuation in a regulated market.

Figure 12.1 illustrates a regional electricity market where the market price (p_M) is regulated at p_R. At this price, the short-run market demand (D_{SR}) exceeds the short-run supply of electricity (S_{SR}) such that there is an excess demand (Q_D – Q_S). Over time with expanded investment in electricity supply as well as possible adjustments in the investments in electricity using equipment the market could come to equilibrium between the long supply (SLR) and long run demand (DLR) at the regulated price p_R. Disequilibria may persist, however, for an extended period if investment in added production capacity lags behind the growth in demand at the regulated price. This is not uncommon because of the capital intensity of the electricity sector causing long planning and investment periods combined with delays and uncertainty caused by regulatory processes.

Figure 12.1: Excess Demand for Electricity in a Regional Electricity Market



In the short run, some mechanism is needed to bring the market to equilibrium. Two classes of mechanism are recognized — price and quantity rationing mechanisms. Pure quantity rationing mechanisms are difficult to enforce as the beneficiaries of a ration can typically resell their ration in a parallel market at a higher price if excess demand exists. For example, in Figure 12.1, the quality supplied (Q_S) at p_R actually commands a price by electricity users of p_D which exceeds p_R. Hence, a user buying electricity at p_R theoretically could resell the electricity at p_D and earn a surplus of ($p_D - p_R$) per kWh resold. In most markets where goods are storable, nonperishable and salable at low transaction costs, rationed items that are in short supply would be resold at higher prices in parallel markets. Effectively, this is equivalent to price rationing bringing the market back to equilibrium. Electricity, however, is difficult to store and resell, and hence, quantity rationing is feasible and often used. Price rationing, however, could be used to remove the excess demand for electricity.

A number of price rationing mechanisms are possible. Price rationing can be achieved by adding a tax or surcharge to raise the price to users up to p_D. Alternatively, quota could be used to restrict demand, but the quota could either be auctioned or sold at a quota price of ($p_D - p_R$) per kWh, or the quota could be tradable such that the resale price of the quota would be ($p_D - p_R$) per kWh. Users of electricity would then pay the regulated price (p_R) plus the tax, surcharge or quota price of ($p_D - p_R$), resulting in the market clearing price of p_D being paid by users.

Economic Value of a Price-regulated Goods with Price Rationing

If an electricity generation project is implemented in a market with a regulated price and price rationing, then the economic value of the added electricity supplied can be estimated using the techniques already presented for nontraded goods. The only difference is that the market price to other electricity producers does not decline because of the price regulation so that other producers do not reduce their supply in response to the added supply. This means that all the added supply gets absorbed by incremental demand and the ration or quota price, tax or surcharge becomes lowered for this added demand to happen.

Figure 12.2 illustrates the market adjustment to absorb the added electricity supply in the case of price rationing being used to control the excess demand. Without the new electricity supply project, the market demand is constrained to the supply of Q_{S0} kWh by the surcharge of ($p_{D0} - p_R$) per kWh. The new project expands the supply by ($Q_{S1} - Q_{S0}$) such that the electricity surcharge drops to ($p_{D1} - p_R$) or the full price paid by users drops from p_{D0} to p_{D1}. The gross economic benefit of this expanded supply is given by the area under the demand curve or area $Q_{S0}EFQ_{S1}$. The economic price of the electricity supplied by the project (p^e) is this value divided by the project supply ($Q_{S1} - Q_{S0}$) or the average demand price for this incremental supply or $p^e = (p_{D0} + p_{D1})/2$.

Economic Value of a Price-regulated Goods with Quantity Rationing

As noted above, quantity rationing is relatively common in regulated electricity markets since quantity rationing can be made effective because of the difficulties of the user in reselling electricity.

Figure 12.2: Valuation of Added Electricity Supply in a Market with Excess Demand that is Removed by Price Rationing.

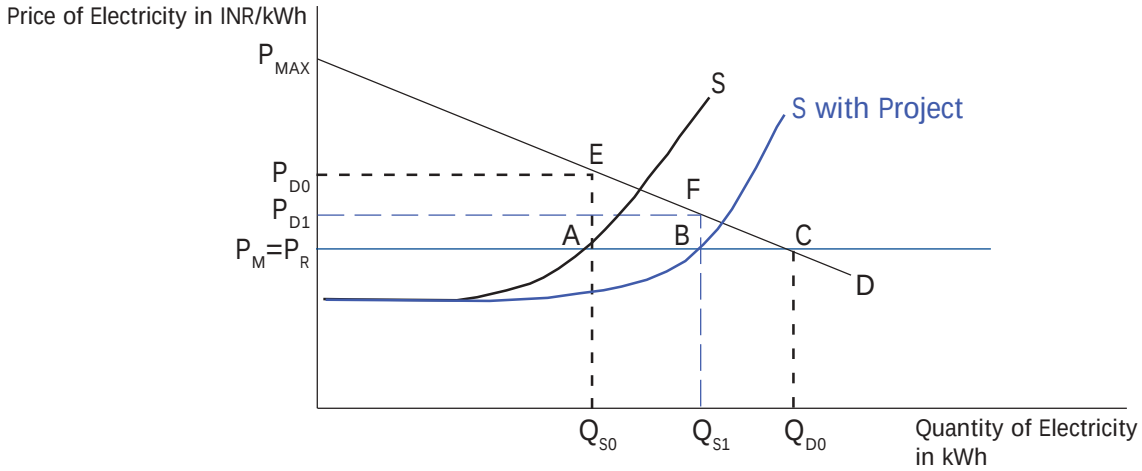
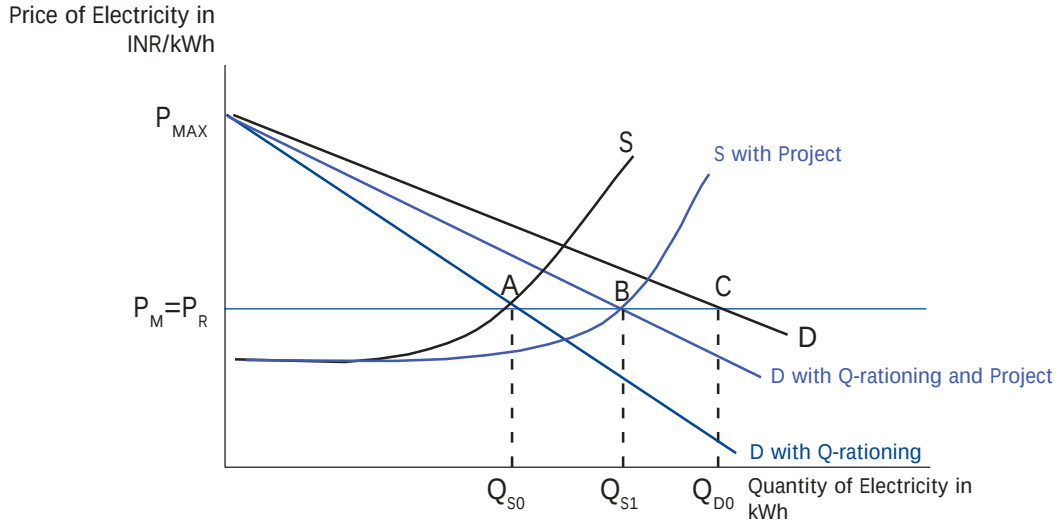


Figure 12.3: Valuation of Added Electricity Supply in a Market with Excess Demand that is Removed by Quantity Rationing (Q-rationing)



Part 13: Evaluation of Stakeholder Impacts in Cost-benefit Analysis

Introduction

The social analysis of a project may be organized into two parts; estimating how the income changes caused by the project are distributed (including the reconciliation of financial, economic, and distributional appraisals), and identifying the impact of the project on the principal objectives (basic needs) of the society. The distributional analysis or the stakeholder analysis is the subject of this Part.

The distributive analysis of the project asks the following questions: Who will benefit from the project and by how much? Who will pay for the project and how much will they pay? Project sustainability is heavily impacted by which party in the project's sphere of influence gains or loses. If an influential group is expected to bear the burden of losses, then the successful implementation of the project may be hindered. The risk of a strong political opposition to the project mobilized by the losing party is a contingency that the project implementers should be prepared to tackle.

Distributive Analysis

A traditional financial analysis examines the financial feasibility of the project from the owners' and total investment point of view. Economic analysis evaluates the feasibility from the point of view of the whole country or economy. A positive economic net present value (NPV) implies a positive change in the wealth of the country, while a positive net present value from the point of view of those with a financial interest in it, indicates a positive expected change in the wealth of these particular stakeholders.

The difference between the financial and economic values of an input or output represents a benefit or a cost that accrues to some party other than the financial sponsors of the project. These differences can be analyzed by undertaking a distributive analysis that allocates these externalities (differences between economic and financial) to the various parties affected. For example, a project that causes the price of a good to fall will create economic benefits that are greater than its financial revenues. This difference between the financial and the economic values will represent a gain to the consumers of the output and a somewhat smaller loss to the other producers of the goods or service who are competing in the market with the project. The differences between the financial and economic values of inputs and outputs also may arise due to a variety of market distortions such as taxes and subsidies, or because the item is sold to consumers at a price different from the marginal economic cost of additional supply.

Tariffs, export taxes and subsidies, excise and sales taxes, production subsidies and quantitative restrictions create common market externalities. Public goods are normally provided at prices different than their marginal economic costs. The economic values of common public services such as clean water and electricity are the maximum amounts people are willing to pay for these services. These values are often significantly greater than the financial prices people are required to pay for the services. Any of these factors will create divergences between the financial and the economic prices of goods and services consumed or produced by a project.

A distributive analysis is composed of six distinct steps:

1. Identify the externalities.
2. Measure the net impact of the externalities in each market as the real economic values of resource flows less the real financial values of resource flows.
3. Measure the values of the various externalities throughout the life of the project and calculate their present values (using the economic discount rate).
4. Allocate the externalities across the various stakeholders of the project.
5. Summarize the distribution of the project's externalities and net benefits according to the key stakeholders in society.
6. Reconcile the economic and financial resource flow statements with the distributional impacts.

In essence, a distributive analysis seeks to allocate the net benefits/losses generated by a project. As a result, this analysis is important to decision makers, as it lets them estimate the impact of particular policies or projects on segments of society, and to predict which groups will be net beneficiaries and which groups will be net losers.

Reconciliation of Economic and Financial Values of Inputs and Outputs

When the economic values and corresponding financial values of variables are expressed in terms of the same numeraire, then we wish to show for each variable that the economic value can be expressed as the sum of its financial value plus the sum of the externalities which cause the financial and economic value to differ. These externalities may be reflecting such things as taxes, subsidies, changes in consumer and producer surplus or public goods externalities.

If each of the variables are discounted using any common discount ratio (in this case the economic discount rate), it must also be the case that the net present value of the economic net benefits are equal to the net present value of the financial net benefits, plus the present value of the externalities.

This relationship can be expressed as in equation (1) below:

(1) $NPV^e_e = NPV^f_e + \sum PV_e (EXT_i)$,

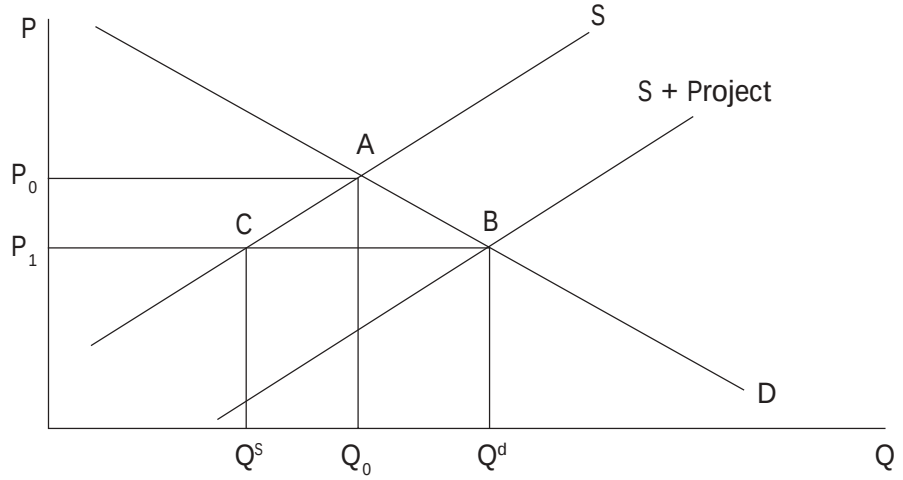
where NPV^e_e is the net present value of economic benefits and costs, NPV_e^f is the net present value of the financial benefits and costs, and $\sum PV_e (EXT_i)$ is the sum of the present value of all the externalities generated by the project; all discounted using a common rate of discount.

To indicate how this relationship holds for nontraded and traded goods, the following situations are considered.

The Case of a Major Expansion in the Supply of a Nontraded Goods in an Undistorted Market

Figure 13.1 illustrates the market of a good that is the output of a project and the market is undistorted. The project results in a nonmarginal increase in the supply of a nontraded goods in a market with no tax or subsidy distortions. One such example would be a project that increases the supply of drinking water, at a lower cost,

Figure 13.1: Financial and Economic Values for Production of Nontraded Goods in Undistorted Market



hence expanding total consumption while also reducing the quantity generated by higher cost plants.

Before the project was introduced, the equilibrium price and quantity were P_0 and Q_0, respectively. P_0 represents the price paid for drinking water prior to the project. Introducing the project causes the supply curve to shift to the right. Price falls to P_1, which is the price of drinking water after the project; total demand increases to Q^d, and the quantity supplied by others is reduced to Q^s. The financial value of the output is Q^sCBQ^d and the economic value is Q^sCABQ^d. The difference (economic-financial) is CAB, which is the sum of two distributional impacts. CAB is the difference between the gain in consumer surplus, P_1P_0AB, and the loss in producer surplus, P_1P_0AC.

In summary, when there are no distortions in a market, the gross value of a nontraded goods or service from a project which causes a significant change of the price of the goods or service can be decomposed into:

Economic Value of the output = Financial Value of the output + Gain in Consumer Surplus - Loss in Producer Surplus

While the example assumes that there is a market determined price before and after the project, this could just as easily be an illustration of public services such as a road, before and after it has undergone a major improvement. In such a case, P_0 would reflect the time and operation costs (per vehicle-mile) before the project, and P_1 would be the sum of these costs per vehicle-mile after the project.

The Case of Nontraded Goods Sold into a Market with a Unit Tax[48]

We will now introduce a distortion into the market. Now we have added a unit tax on the

[48] The illustration in this case is for a unit tax, but the same results also hold for ad valorem taxes imposed on goods or services. The computation is somewhat more involved.

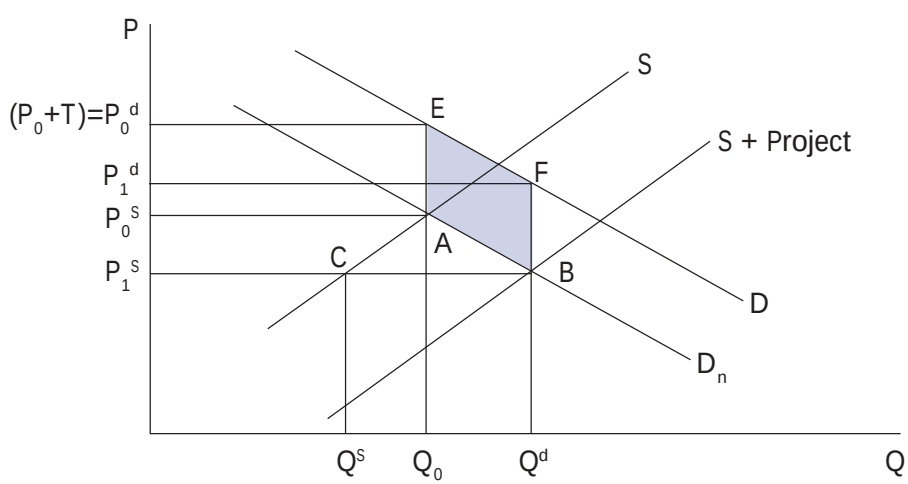
nontraded goods, which results in the demand curve facing the producer to shift downward to Dn. Before we introduce our project to the market, we have an equilibrium quantity of Q_0, a supply price of P^s_0, and a demand price of P^d_0, which is equal to the supply price plus the unit tax. After we introduce the project, the quantity demanded increases to Q^d, quantity supplied by producers other than the project falls to Q^s, the supply and demand prices fall to P^s_1 and P^d_1, respectively. The financial value of the output is shown as Q^sCBQ^d. The economic value is shown as Q^sCAQ_0 which is the value of resources saved through the contraction or postponement of supply by others, in addition to Q_0ABQ^d plus AEFB, the value to consumers of the increase in the quantity demanded.

The difference between the economic and financial appraisal of the project's output in this case is equal to CAB plus AEFB. Here again, CAB represents the gain in consumer surplus, $P^d_1P^d_0EF$, minus the loss in producer surplus, $P^s_1P^s_0AC$. This is easy to see in the case of a unit tax because $(P^s_0 – P^s_1)$ must equal $(P^d_0 – P^d_1)$. Hence, the area $P^d_1P^d_0EF$ must equal $P^s_1P^s_0AB$.

In summary, when there are no distortions in a market, the gross value of a nontraded goods or service from a project which causes a significant change of the price of the goods or service can be decomposed into: Economic Value of the output = Financial Value of the output + Gain in Consumer Surplus - Loss in Producer Surplus

The area AEFB is equal to $T(Q_d-Q_0)$ or the net gain in government revenue that results from the increased demand. The gross economic value of the output is, therefore, equal to the financial value plus the change in government tax revenues plus the increase in the consumer surplus minus the loss in producer surplus. Consumers gain as a result of the lower price of the goods. Producers lose because of the fall in price and reduced production; and the government collects more tax revenues, because of the expansion in the quantity demanded due to the lower price.

Figure 13.2: Financial and Economic Values for Production of Nontraded Goods with a Unit Tax



In summary, when the market is distorted only by a unit tax, the gross economic value of the output of a project can be expressed as:

Economic Value of output = Financial Value of output + Change in Government Tax Revenues + Increases in Consumer Surplus - Loss in Producers Surplus

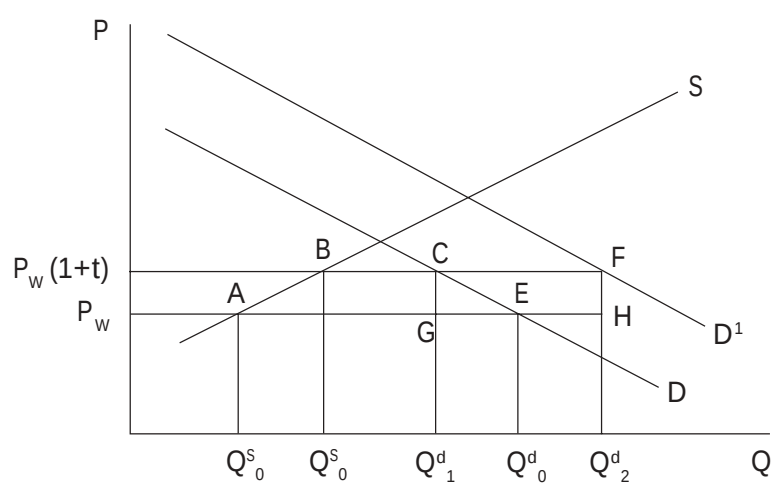
The Case of an Importable Input that is Subject to Tariff

In Figure 13.3, the case of an importable goods is illustrated where the inputs of the item are subject to a tariff at a rate of t. The CIF price is P_w and the domestic price is $P_w(1+t)$. The initial market equilibrium is found at the domestic price of $P_w(1+t)$ where the quantity demanded is Q^d_1 and the quantity supplied by domestic producers is Q^s_1. The quantity imported is $(Q^d_1-Q^s_1)$. The CIF price is P_w. A new project now demands an additional quantity of this item as an input. This addition to demand is shown in Figure 13.3, as a shift in the market demand curve from D_0 to D_1.

Because it is an importable good, this increase in demand will lead to an equal increase in the quantity of the item imported of $(Q^d_2-Q^d_1)$. The financial cost of the additional imports is $P_w(1+t)(Q^d_2-Q^d_1)$, while the economic cost is equal to $P_w(Q^d_2-Q^d_1)(E_e/E_m)$; where E_e is the economic exchange rate and E_m is the financial market exchange rate.

The difference between the economic and financial costs of the importable good can be expressed as $[E_e/E_m - 1]\ P_w\ (Q^d_2-Q^d_1)$ — $t\ P_w\ (Q^d_2-Q^d_1)$. The first term of this expression is the rate of foreign exchange premium $[E_e/E_m - 1]$ times the cost of the inputs purchased at world prices P_w. This measures the externality, usually tariff revenues foregone, from the use of foreign exchange to purchase the input. Tariff and taxes would have been paid if the foreign exchange required for this purchase had been used to purchase other imports. The second expression is the tariff revenues paid by the project when it imports these inputs.

Figure 13.3: Measuring Distributive Impact from Financial and Economic Values of Inputs with Tariffs



The net distributional impact on the government is the difference between the two effects. The government gains revenue as a result of the imposition of the tariff, but loses because the use of the foreign exchange elsewhere also would have yielded some tariff revenues. (In the case of a quota, those who have import licenses are the beneficiaries of the premium on foreign exchange).

In summary, for the case of an importable good subject to a tariff, the economic cost of the item can be expressed as follows:

Economic cost of importable input =

Financial cost – gain to the government from the tariff revenues paid on the purchase of the item +loss in government revenues due to the foreign exchange premium on the foreign exchange used to purchase this input.

Thus, if each of the values for the input and output variables that make up a project are broken down into their economic, financial and distributional components, then the end result can be expressed as in equation (1) where the net present value economic is equal to the net present value of the financial outcome of the project, plus the present value of a series of distributional impacts on the various stakeholders of the project.

Part 14: Institutionalizing the Project Appraisal Process

Institutionalization Process

The Institutionalization process begins at the start of the project capacity-building training programs, not afterwards. The process of iinstitutionalizing the "international best practice" project appraisal process described in this Guidebook has three dimensions:

1. Establishment of Project Formulation and Appraisal Division (PFAD) in each of the REFORM State.
2. Issue of a Government Order making project appraisal mandatory for projects involving investments of a minimum threshold.
3. Inclusion of project appraisal training programs in the training calendars of State level Administrative Training Institutes (ATIs).

Project Formulation and Appraisal Division

The objective of Project Formulation and Evaluation in a planned economy is basically to ensure the selection of such projects which contribute most to the economic and social objectives laid down in the Plan. State Governments should identify, formulate and appraise projects within the framework of the State Plan which sets out the broad objectives, policies and tentative targets for sectoral and the overall growth of economy. The tentative share of different sectors like industry, agriculture, health, education, power, mining, transport, public works, etc. is determined mainly on the basis of past experience and availability of resources. In order to achieve sectoral and subsectoral targets envisaged in the plan, projects are identified by the Administrative Departments and if the identified projects are found to be viable on preliminary examination, detailed feasibility reports are prepared.

The objective of Project Formulation and Evaluation in a planned economy is basically to ensure the selection of such projects which contribute most to the economic and social objectives laid down in the Plan. State Governments should identify, formulate and appraise projects within the framework of the State Plan which sets out the broad objectives, policies and tentative targets for sectoral and the overall growth of economy.

Though planning in REFORM States started since the formation of the states, in recent times, project preparation and appraisal has not received adequate attention. Feasibility reports are appraised generally and lack in adequate appraisal, with the result that substantial cost and time overruns became a common feature of public sector projects. In addition, there is no set of uniform criteria which could link the state policies with project selection, that leaves much scope for arbitrary decision. Projects are approved on files which move from one department to another taking substantial time for final decision. In order to improve project formulation capabilities in the State and to ensure objective and scientific appraisal of projects, Project Formulation and Appraisal Division (PFAD) needs to be created in the State Planning Department. To have effective decision making mechanism, PFAD should act as the Secretariat to the Expenditure Finance Committee (EFC) for approval of projects costing more than INR five crores. The Director of

PFAD should be the ex-officio Secretary of the EFC.

Objectives:

The Project Formulation and Appraisal Division (PFAD) shall be created in the Planning Department, with a view to assisting the State Government in taking investment decisions in a manner which would ensure optimal utilization of scarce resources and accrual of benefits commensurate with investments. PFAD will, therefore, examine different investment alternatives and funding options before these are cleared for funding and implementation so that their successful and timely completion is assured and the society derives the desired benefits.

Functions:

The major proposed functions that may be assigned to the PFAD are:

1. To provide assistance to various development departments in the formulation of projects on scientific basis.
2. To carry out ex-ante appraisal of the projects from technical, financial, commercial, economic and social points of view to justify their worth to the society.
3. To scrutinize projects in the context of sectoral programs and overall requirements of the plan.
4. To motivate different development departments to adopt "shelf of projects" approach, to prioritize projects depending upon availability of funds and demand-supply gap.
5. To carry out basic economic studies for various sectors referred to it by the State Government.
6. To perform the role of Secretariat and technical wing of the EFC by undertaking objective appraisal of investment proposals submitted before it.
7. To review all such projects which have not been taken up for execution even after six months from approval of the EFC.

As recommended at 6 above, The Project Formulation and Appraisal Division (PFAD) shall be the Secretariat of the EFC.

Under the proposed system, projects to be executed by the State Departments and Corporations, projects costing more than INR 5.00 crores shall be submitted to EFC for detailed analysis and appraisal.

It is recommended that the EFC be chaired by the Principal Secretary (Finance). Other members of the EFC are proposed as follows:

- Secretary, Finance Department;
- Secretary, Planning Department;
- Secretary, Forest and Environment;
- Secretary, Concerned Administrative Department
- Chief Engineer (PWD);
- Director, PFAD, Ex officio Member Secretary; and
- MD/Chief Engineer of Concerned Working Agency.

The PFAD shall act as the Secretariat of EFC and shall appraise projects for its consideration. The recommendations of EFC shall be submitted to the State Cabinet by the concerned Department for final decision.

Investment proposals of the following magnitude and description should come within the purview of the EFC:

(a) Investment proposals of Government departments, existing public sector enterprises, and statutory bodies (excluding local bodies) set up by the State Government, involving investment in projects more than INR five crores;

(b) Joint sector or assisted sector projects involving an investment of INR one crores or more in the form of equity of the State Govt. or its agencies;

(c) Projects for which the revised cost is likely to exceed the cost approved by the EFC by 20 percent or more;

(d) All proposals relating to the setting up of a new corporation or subsidiary companies irrespective of the quantum of investment by the State Government or its undertakings; and

(e Investment proposals costing INR one crore or more but less than INR five crore may, if referred to it by the Administration Department, be appraised by the PFAD and sent back with its recommendations to the concerned Administrative Department.

Organization:

The PFAD's structure could be as below:

Director	1
Joint Director	1
Senior Research Officer	2
Research Officer	4
Research/Statistical Assistant	6

The Director and Joint Director, in addition to administrative work, shall guide the staff of PFAD in conducting appraisal and various studies. One of these should be an Engineer and the other an Economist, both having extensive experience in project appraisal.

Similarly, one Senior Research officer and two Research officers should be Engineers and another similar set should consist of Economists with each incumbent having some experience in Project Appraisal. The Research Assistant shall assist the officers in day to day work. Two each of these should have the background of engineering, economics and statistics.

The posts may be filled in a phased manner depending on the workload.

The officials of PFAD and the appraising officers of line ministries would be trained by REFORM Project.

Scope of Expenditure Finance Committee (EFC):

(a) All proposals, with annual recurring expenditure of INR 50 lakhs/nonrecurring expenditure of
INR five crores or more, will be presented before EFC;

(b) All schemes, where assets/investments of state government are required and the project is in PPP framework, will be presented before the EFC;

(c) All proposals, where the concerned department has fixed standards of expenditure and has fixed standard estimates of energy consumption unit and the non recurring expenditure is less than
INR five crores, will be presented to EFC for general examination only;

(d) Normally, such proposals (referred to in (a) (b) and (c) above) will be examined by EFC before their inclusion in the budget. Proposals below the level of INR five crores will be examined as per fixed procedure prior to its financial approval;

(e) If the revised estimate of nonrecurring works/schemes is 20 percent or more than the original estimates, a de novo examination of the project will be done by the EFC. If the revised estimates are less than 20 percent of the original then estimates will be examined by the related Expenditure Control Section of the concerned Administrative Department. Enclosed pro forma will be used in both the cases; and

(f) In special cases, proposals not falling within the jurisdiction of the EFC may be sent to the PFAD for examination and advice.

Explanation:

- Unit of expenditure means such works which are proposed to be done separately in an independent manner; and
- Estimates of investment should be comprehensive to include all related heads so that the project can be completed.

Work Procedure of the Expenditure Finance Committee:

1. EFC will meet twice in a month depending upon the workload and urgency of the project approval.
2. EFC may invite or coopt experts, consultants, officers to its meetings.
3. Proposals will be examined in depth by the Departmental Committee under the chairmanship of Secretary of the department before being presented to the EFC.
4. Following information/data will be necessary for the EFC:
   - An analysis of the sector/ present situation;
   - Short description with Plan details and objectives;
   - Problems that are to be addressed by the project;
   - Project objectives, including necessity of the Project — have other alternatives been examined?
   - Project strategy;
   - Project budget and means of finance;
   - Target beneficiaries;
   - Legal Framework;
   - Environmental impact assessment / clearances obtained;
   - Technological issues;
   - Management arrangements;
   - Project time frame;
   - Financial and Economic Analysis (See Annexure 1);
   - Risk Analysis-only for infrastructure projects (See Annexure 1);
   - Evaluation;
   - Success criteria; and
   - Sustainability.
5. Detailed examination of all projects will be done by the PFAD before presentation to EFC.
6. These notes and comments will be made available in advance, say at least seven days, to all members of EFC.
7. The minutes of the EFC will be approved by

the Chairman and issued by the Member Secretary.

8. Approvals from higher authorities may have to be taken as per the Rules of Business, wherever necessary.
9. Decisions of EFC shall not be reopened in the Planning or Finance department.

Initial objections or requests for any additional information should also be compiled and dispatched to the members of EFC, along with replies, if any.

Issue Government Order:

To make the project appraisal mandatory, the Finance Department of the State Government would be required to issue a GO. The draft of such GO is placed at Annexure – 4.

Inclusion of the PA Training Program in the Training Calendar of State Level ATIs:

As the economy of each State would be growing over time, we will be required to add trained officers each year to take care of the appraisal of the projects. This can be done only if the ATIs include the training programs on Financial, Economic, Stakeholder and Risk Analysis in their respective training calendars. The suggestive syllabi of three modules is placed at Annexures 6, 7 and 8.

Project Appraisal Implementation Road Map:

Overview:

- The Institutionalization process begins at the start of the project capacity-building training programs, not afterwards;
- This process is manifested *via* government ownership and commitment and identification of trainees to serve as trainers and change agents in their respective departments;
- Buy-in of government decision makers about the methodology and results is essential from the beginning; and
- Institutionalization encompasses: codification through government orders or legislation; developing change agents in government offices; and, developing and scheduling capacity-building training programs in government or government-affiliated training institutes.

Step 1: Government Buy-in and Commitment:

- Orient the decision makers about the methodology;
- Customize the training material to cater to local needs;
- Prepare case studies based on live projects; and
- In coordination with the nodal ministry, identify the ministries whose officers are to be trained.

Step 2: Capacity-building Training Programs:

- Conduct the training programs on Financial, Economic, Stakeholders and Risk Analysis;
- At the beginning of the program, make groups who have to work on the live cases of their departments for hands-on training;
- Mentor the participants till they complete their live case studies using best international practices of Project Appraisal; and
- Train the identified faculty of Government

Training Institutes along with the officers of selected departments.

Step 3: Institutionalization:

- In coordination with the nodal ministry, prepare a blueprint for establishment/ reorganization of Project Formulation and Appraisal Division;
- Identify participants who have the potential to become a trainer/Project Appraisal Analyst;
- Further, mentor the identified participants/ identified faculty of Government Training Institutes;
- Involve the participants in developing sector-specific guidelines;
- Hand over the training material and sector-specific guidelines to the nodal ministry to get their feedback;
- Improve the training material and sector-specific guidelines based upon the feedback and hand over the final version to the nodal ministry;
- Follow up with the ministry so that necessary orders are issued for adopting the international best practices of Project Appraisal in decision making;
- Follow up with the ministry/Government Training Institutes for inclusion of training modules of Project Appraisal in their training calendar; and
- Mentor the activities initially and then gradually fade out.

Please see Annexure 9 for more information on how the REFORM project appraisal process was implemented in its three partner states of Jharkhand, Karnataka and Uttarakhand.

Part 15: Summary of Project Appraisal Results and Recommendtion for Action

The following Table 15.1 provides a summary of the basic results expected from the appraisal of an investment project using the financial, economic, stakeholder and risk analysis techniques discussed in the previous sections.

Based on the set of results derived from a comprehensive analysis of an investment

Table 15.1: Summary of Project Appraisal Results

Criterion or Result	Primary or Basic		Secondary
	Self-financing project	Nonself-financing Project	
Economically Attractive? NPV for Economy	$NPV_{econ} > 0$ Also, IRR $_{economic}$ > economic discount rate	$NPV_{econ} > 0$ Also, IRR economic > economic discount rate	Probability of $NPV_{econ}<0$, standard deviation, maximum and minimum values or confidence intervals. Sources of risk
Financially Attractive to Equity Holders or Sponsors? NPV for Equity Holders or Sponsors	$NPV_{equity} > 0$ Also, IRR equity > minimum required RoE (return on equity)	$NPV_{sponsor}$ such that injections of funds are available in both investment and operating periods to cover any negative cash flows	Probability of $NPV_{equity}<0$, standard deviation, maximum and minimum values or confidence intervals. Sources of risk, impacts of risk-sharing contracts, sales or purchase agreements
Financially Attractive to Combined Financiers? NPV to Total Investment	$NPV_{total\ investment} > 0$ $NPV_{total\ investment} = NPV_{equity}$ Also, IRR total investment > minimum required return on investment RoI (WACC)		Adequate debt coverage ratios or sufficiently low probability of default relative to default premium charged
NPV to Stakeholders Consistent with NPV for Economy	NPV_{econ} = sum of NPV to stakeholders	NPV_{econ} = sum of NPV to stakeholders	
NPV to Key Stakeholders	NPV to equity holders, NPV to adversely affected groups through environmental impacts, labor adjustment or social dislocation	NPV to target beneficiary group, particularly for social program delivering basic needs	Standard deviation, maximum and minimum values or confidence intervals. NPV of target group relative to NPV economy: win-win or target groups wins at expense of economy?

project the following is the typical range of recommendations:

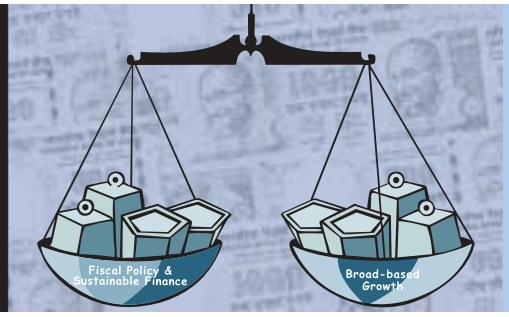
1. For a self-financing project, where it is:

- Both financially and economically attractive with manageable risks and no key stakeholder group expected to experience major unintended gains or losses, the project should proceed as designed;
- Subject to government regulation or participation agreements and is economically attractive and excessively attractive to the private investors, the project should proceed but with reduced gains to the private investors through adjusting contract prices or otherwise renegotiating the agreements;
- Economically attractive, but financially unattractive to the stakeholders, the regulated prices or contract agreement should be adjusted to make the contract sufficiently attractive to the private investors by adjusting prices and/or introducing risk sharing arrangements to reallocate risks and/or improve performance incentives;
- Financially attractive, but economically unattractive (as may occur in a protected or subsidized sector), the degree of protection or subsidy should be reduced such that the investment becomes economically attractive, if feasible; and
- Both financially and economically unattractive, it should be reconsidered for project redesign — changed scale, timing, technology, real options, and/or financial and contractual arrangements — to assess whether the project can be made attractive under new design parameters or agreements.

2. For a nonself-financing project, where it is:

- Economically attractive, has secure operational finances and the target beneficiary group experiences intended gains (typically from added supply of a basic need), and no key stakeholder group expected to experience major losses, the project should proceed as designed;
- Economically attractive, but has insecure operational finances, it should be reassessed based on reduced production of services and beneficiary gains to assess whether it remains economically attractive under realistic financing levels for its operations; otherwise it should be deferred until financing of its operations can be assured; and
- Economically unattractive, has secure operational finances and the target beneficiary group experiences intended gains (typically from added supply of a basic need), the project should be considered for redesign to determine whether at a different scale or with a different technology it can deliver adequate benefits to the target stakeholders, but with either positive economic gains or limiting the economic losses to a small share (say below 20 percent) of the gains of the target group; otherwise reject the project.[49]

[49] The beneficiary group could be assisted with a cash transfer equal to their expected gain less the economic cost of raising and administering the funds transferred (typically about 20 percent of the funds.)



Annexures

Annexure 1:

Economic Opportunity Cost of Foreign Exchange

Introduction

In project appraisal, there are two important national parameters. The first national parameter is the economic opportunity cost of capital, which measures the economic opportunity cost of using the capital resources in the specific project rather than in alternative uses in the economy. If there are distortions in the capital markets, such as taxes and subsidies, then there will be a discrepancy between the financial cost of capital that is applied to the cash flows in the financial analysis and the economic cost of capital that is applied to the corresponding economic cash flows for the investment project. The methodology to estimate this is outlined in Annexure 2.

The second national parameter is the economic opportunity cost of foreign exchange. Distortions in the markets that determine the supply and demand of foreign exchange (commonly, trade and other indirect taxes on tradables) also result in the economic exchange rate differing from the financial (official or market) exchange rate. Typically these distortions result in the economic value of the foreign exchange being higher than the financial value of the foreign exchange, in which case there is a positive foreign exchange premium. Trade taxes and taxes on consumption (such as sales taxes, VAT or excise duties), importantly, tend to reduce the market demand for imports which, in turn, reduce the demand for foreign exchange. This results in the strengthening in the market exchange rate or a positive foreign exchange premium. (The effects of tax distortions are elaborated further below.) In the calculations of the conversion factors for the converting line items in the financial analysis to their economic values, we have to take into account the value of the foreign exchange premium. If, for example, there are traded inputs (or outputs) in the project, then the value of the traded inputs (or outputs) must be adjusted for the economic opportunity cost of foreign exchange in the presence of trade distortions to the extent that the use (or production) of these traded goods results in added demand for (or supply of) of foreign exchange.

In some countries with controlled exchange rates, there may be a parallel market for foreign exchange. In the parallel market, the "black market" exchange rate may be higher than the official exchange rate. As a first approximation, in the absence of any other information, the difference between the exchange rate in the parallel market and the official exchange rate is probably an underestimate of the foreign exchange premium as it excludes the component arising from tax and subsidy distortions.

Generally, the project analyst does not have the expertise, experience, resources or time to conduct a reliable estimation of these national parameters. Typically, the appropriate government agencies will provide guidelines or estimates for national parameters. Ideally, for example, foreign exchange premium estimates should be derived from a fairly disaggregated general equilibrium model of the economy that captures the major distortions affecting the foreign exchange market. However, it is important for the project analyst to be comfortable with the principles behind the estimation of the two national parameters and how they relate to the overall economic

appraisal of the investment project. For India, some rough calculations suggest that the foreign exchange premium is approximately 12 percent.[50]

Simple Example of Effect of a Trade Distortion

In this Section, we provide an informal introduction to the economic opportunity cost of foreign exchange. To illustrate the key concepts concerning the role of trade in the foreign exchange market, we begin with a simple numerical example. Then we present an informal introduction to the underlying theoretical framework for estimating the economic opportunity cost of foreign exchange by examining the market for foreign exchange.

Consider a simple case in which the only domestic distortion on the importation of a machine required for a project is an import tariff of 20 percent. Suppose the machine costs INR 10.8 lakhs in the domestic market. It does not matter whether the machine is imported or its (comparable) equivalent is produced domestically. The key question is whether the machine is tradable on the world market. Also, we have to examine the final impact of the project's demand for an additional unit of the machine. In other words, it does not matter whether our specific project imports the machine. As explained below, what matters is the **final** impact in the market for imported machinery.

In project appraisal, there are two important national parameters. The first national parameter is the economic opportunity cost of capital, which measures the economic opportunity cost of using the capital resources in the specific project rather than in alternative uses in the economy. The second national parameter is the economic opportunity cost of foreign exchange.

If the project imports the machine, then the quantity of imported machines in the economy increases by one unit. However, if the project purchases a comparable machine that is produced domestically, it means that another project would not be able to purchase that comparable machine. And therefore, that other project would have to import a machine. The final impact of the demand by the project for the machine leads to a unit increase in the number of imported units in the economy even though our project may not purchase an imported machine.

Numerical Example

We have assumed that the imported machine and the machine that is produced domestically are comparable. Consequently, in competitive markets, the market prices for the two machines are the same. In domestic currency, the price of the machine is INR 10.8 lakhs.
We assume that the foreign exchange rate is INR 45/USD. In foreign currency, the price of the machine is USD 240,000, inclusive of an import tariff of 20 percent. The CIF price of the machine, excluding the import tariff, is USD 200,000.

[50] Rough estimates of the foreign exchange premium (FEP) in India arising from trade taxes and other indirect consumption taxes, show that it has dropped from around 30 percent in 1990 to around 20 percent by the later half of the 1990s and further to around 11 percent to 12 percent by 2004. This drop has primarily come about with the reduction in import duties on international trade and the major expansion in international trade as a share of the GDP as the India economy has been opened up over the past decade. By contrast the contribution of domestic consumption taxes to the FEP has remained steady in the range of about 6 percent to 7 percent.

If there were no tariff, then the price of the machine would be the CIF price, which is the world price. However, the tariff provides protection to the domestic producers who price the machines at the world price plus the import tariff. The project has a choice. At the **same** price, the project can either buy the imported machine at the CIF price plus the import tariff, or the domestically produced machine.

The financial price of the machine is INR 10.8 lakhs. The economic value of the machine is the world price of INR nine lakhs, exclusive of the import tariff. If there were no tariff, then the project could have purchased the machine for INR nine lakhs. Thus, the economic opportunity cost of the machine is INR nine lakhs, which is the world price of the machine.

Up to this point, we have not discussed the economic value of the foreign exchange. The foreign exchange component of the machine equals the value of the machine at the world price or the amount of foreign exchange resources the economy has to forgo to get an additional machine. Therefore, the incremental demand for USD that is USD 200,000. The import duty of USD 40,000 is a transfer from the importer to the government and is not an economic cost. However, there may be other distortions in the foreign exchange market, which means that there might be a foreign exchange premium. Assume that the foreign exchange premium is 12 percent. This means that the economic value of the foreign exchange is higher than the CIF by 12 percent and the economic value of the machine equals USD 224,000.

The details of the calculations are shown in the Table. This reviews the main concepts just covered. The financial cost of the machine is INR 10.8 lakhs (in domestic currency) or USD 240,000 (in foreign currency).

The economic cost of the machine, without taking into account the foreign exchange premium, is INR nine lakhs (in domestic currency) or USD 200,000 (in foreign currency). The economic cost of the machine, taking into account the foreign exchange premium, is INR 10.08 lakhs (in domestic currency) or USD 224,000 (in foreign currency).

The final conversion factor, which is the ratio of the economic price of INR 10.08 lakhs to the financial price of 10.80 lakhs, is 0.933 or CF1 times CF2 (or 0.833*112).

Market for Foreign Exchange

As stated earlier, to analyze and understand the market for foreign exchange, we use the same analytic framework that we had used for estimating the economic value of nontraded goods. Even though foreign currency is a medium of exchange, we can view it simply as a good called "foreign exchange" with a market equilibrium that is determined by demand and supply curves. Here, we define the price of foreign exchange as the number of units of domestic currency per unit of foreign currency (D$/F$). For example, the current market exchange rate for the Indian rupee is INR 45/USD. The exchange rate in the market for foreign exchange is the financial price for one unit of foreign exchange (one USD). What is the corresponding economic price for one unit of foreign exchange?

To calculate the economic price for one unit of foreign exchange, we have to take into account the distortions in the foreign exchange and

Table A 1.1: Financial and Economic Costs of the Machine

	Fin Value	CF1	Econ Value	CF2	Econ Value
Machinery, CIF, USD, '000	200.00	1.00	200.00	1.12	224.00
Import Duty	40.00	0.00	0.00	0.00	0.00
Market Price, USD, '000	240.00	0.833	200.00	1.12	224.00
Machinery, CIF, INR Lakhs	9.00				10.08
Import Duty, INR Lakhs	1.80				0.00
Market Price, INR Lakhs	10.80				10.08
Conversion Factor (Intermediate)	0.833				
Final Conversion Factor	0.833 112 = 0.933				

The demand and supply curves for foreign exchange depend on the corresponding trade activities that generate the demand and supply for the foreign exchange. On the demand-side, the demand for foreign exchange is derived from the market for importables, where the quantity of foreign exchange demanded equals the value of imports. In turn, the quantity of imports equals the difference between the demand for importables and the supply of importables, and is a function of the exchange rate.

related markets, in the same way that we had calculated the economic price for a nontraded goods. In addition to import duties, export taxes, domestic consumption taxes and other quantitative trade restrictions, there might be controls on the free movement of currencies as well.

We apply the three postulates of welfare economics to the market for foreign exchange. On the demand-side, the demand curve for foreign exchange measures the willingness to pay of the demanders, which in turn is an estimate of the benefits to the consumers. On the supply-side, the supply curve for foreign exchange measures the value of the resources that are required to generate the foreign exchange.

The demand and supply curves for foreign exchange depend on the corresponding trade activities that generate the demand and supply for the foreign exchange. On the demand-side, the demand for foreign exchange is derived from the market for importables, where the quantity of foreign exchange demanded equals the value of imports. In turn, the quantity of imports equals the difference between the demand for importables and the supply of importables, and is a function of the exchange rate.

On the supply-side, the supply of foreign exchange is derived from the market for exportables, where the quantity of foreign exchange supplied equals the value of exports. In turn, the quantity of imports equals the difference between the demand for importables and the supply of importables, and is a function of the exchange rate.

To clarify some terminology that is used to describe the movement of exchange rates, suppose the exchange rate were to increase

from INR 45/USD to INR 50/USD. The increase in the exchange rate could arise from either an increase in the demand for foreign exchange (demand curve moves right), or a decrease in the supply of foreign exchange (supply curve move left). The *higher exchange rate* means that the *domestic currency has depreciated*. There is an inverse relationship. It has gone down in value because now more units of domestic currency are required to buy one unit of the foreign currency.

Conversely, suppose the exchange rate were to decrease from INR 45/USD to INR 40/USD. The decrease in the exchange rate could arise from either a shift to the left of the demand curve, or a shift to the right of the supply curve. In this case, the *lower exchange rate* means the *domestic currency has appreciated*. It has become stronger because now we need fewer units of domestic currency to buy one unit of the foreign currency.

We present the estimation of the economic opportunity cost of foreign exchange in two stages. First, we assume that there are no distortions. Second, we introduce the distortions.

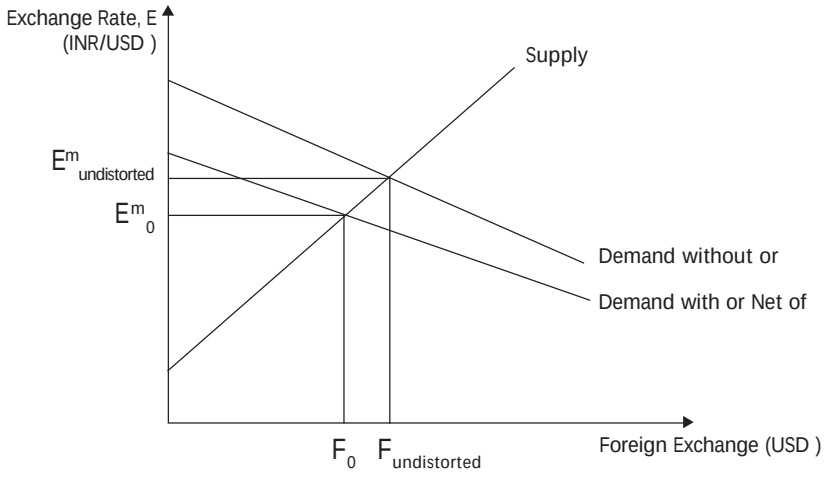
Economic Opportunity Cost of Foreign Exchange without Distortions

If a project demands foreign exchange, say for importing machinery, then the demand curve for foreign exchange shifts to the right. The economic opportunity cost of foreign exchange is a weighted average of the economic values of the demand and supply responses.

Similarly, if a project supplies foreign exchange, say by exporting an output produced by the project, then the supply curve of foreign exchange shifts to the right. Again, the economic opportunity cost is a weighted average of the economic values of the supply and demand responses.

As expected, with no distortions in the foreign exchange market, the economic opportunity cost of foreign exchange equals the financial cost of foreign exchange. In Figure A 1.1, in an undistorted market, the market would equilibrate at an exchange rate $E^m_{undistorted}$ with the quantity of foreign exchange being traded per period at $F_{undistorted}$. Increases in the demand

Figure A 1.1: Market for Foreign Exchange with Import Duties and Domestic Consumption Taxes



for or supply of foreign exchange would result in an economic opportunity cost of foreign exchange, $E^e = E^m_{undistorted}$, as just discussed, or the weighted average of the cost of added foreign exchange supplied from the exportable market or bid away from the importable market would approximate the market exchange rate.

If import duties are imposed on imports and various consumption taxes imposed on domestic demand for goods and services (such as sales taxes, VAT, excise duty, service taxes, etc) then the domestic demands for imports, importables and exportables decline. This effectively decreases the demand for imports and foreign exchange and makes more exportables available to earn foreign exchange from exports. The combined effect of the decreased demand for foreign exchange and the increased supply of foreign exchange is to cause the exchange rate to appreciate. Figure A 1.1 captures this combined effect as an effective tax on foreign exchange. The exchange rate decreases or appreciates from $E^m_{undistorted}$ to E^m_0, while the quantity of foreign exchange falls from $F_{undistorted}$ to F_0.

Now, with tax distortions affecting the foreign exchange market the concept of the economic opportunity cost of foreign exchange can be addressed in a similar fashion to the economic price of nontraded goods.

Economic Opportunity Cost of Foreign Exchange with Distortions

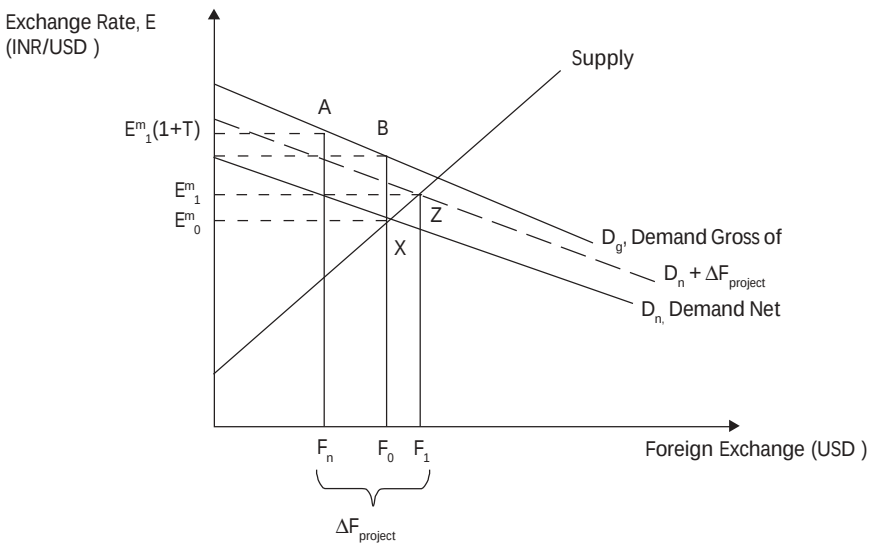
With an effective tax on the use of foreign exchange at rate T arising from import duties and domestic consumption taxes, the effective market demand curve becomes D_n in Figure A 1.2. The market equilibrates at exchange rate E^m_0, and quantity of foreign exchange traded, F_0.

Now if a project demands added foreign exchange, $F_{project}$, the effective market demand curve shifts to the right and the market exchange rate rises to E^m_1 and the foreign exchange traded rises to F_1. Importantly, however, the expansion of the foreign exchange market caused by the added demand is less than $F_{project}$. Part of the demand is sourced from added supply ($F_1 - F_0$) from added exports induced by the increase in the market exchange rate, while the remainder ($F_0 - F_n$) is sourced from a reduction in imports as the exchange rate rises such that some businesses forgo the use of foreign exchange. In other words, a share (W^S) of $F_{project}$ is sourced from added supply of foreign exchange, or $(F_1 - F_0) = W^S F_{project}$, and the remaining share ($W^D = 1 - W^S$) comes from forgone demand for foreign exchange, or $(F_0 - F_n) = W^D F_{project}$.

The economic cost of the foreign exchange used by the project is therefore the sum of the costs of the added foreign exchange supplied and the cost of the forgone foreign exchange demanded. From Figure A 1.2, the cost of the added foreign exchange supply is given by cost of the resources used to generate this supply or the area under the supply curve, F_0XZF_1, while the cost of the forgone foreign exchange demand is the area under the gross of tax demand curve (which measures the full domestic willingness to pay for foreign exchange including the taxes), F_nABF_0. The economic opportunity cost of a unit of foreign exchange, E^e, then is the sum of these two areas divided by the quantity demanded by the project, $F_{project}$. If the rise in the market exchange rate is taken to be small and $E^m_0 \approx E^m_1$, then the economic cost of the foreign exchange demand can be expressed as:

$$F_{project}\, E^e = W^S F_{project}\, E^m_0 + W^D F_{project}\, E^m_0 (1 + T)$$

Figure A 1.2: Economic Opportunity Cost of Foreign Exchange in a Market with Import Duties and Domestic Consumption Taxes



Or the economic exchange rate per unit of foreign exchange as:

$$E^e = W^S E^m_0 + W^D E^m_0 (1 + T)$$

where, E^e is the economic exchange rate or the economic opportunity cost of foreign exchange; E^m_0 is the market price of foreign exchange; T is the effective tax rate on foreign exchange; W^S is the weight of the supply response; and W^D is the weight of the demand response.

The foreign exchange premium, FEP, gives the relative excess of the economic exchange rate over the market exchange rate, or:

$$FEP = (E^e - E^m_0)/E^m_0$$
$$= W^D T$$

In other words, FEP gives the rate at which added taxes are forgone per added unit of foreign exchange used. If the market exchange rate is INR 45/USD and the FEP is 12 percent, then E^e = INR 50.4/USD and each US dollar of foreign exchange used (produced) by the project loses (gains) the economy an added INR 5.4 (or 12 percent of INR 45/USD) in tax externalities.

Actual estimates of the FEP should be based on a general equilibrium model that recognizes that the tax distortions in the economy that are summarized in the effective tax rate on foreign exchange, T, above, actually are distributed across a number of markets that are affected by changes in the market exchange rate arising from added demand or supply of foreign exchange by a project. The tax externalities arise from changes in the taxes induced by the following market responses to an increase in the market exchange rate as a result of a project demand for foreign exchange:

1. Decline in the demand for imports as the supply of importables increases and the demand for importables decreases causing a loss in import duties.

2. Decline in the demand for importables and exportables causing a loss in consumption taxes (such as sales taxes, VAT, excise duties, and service taxes).
3. Increase in exports as the supply of exportables increases and the demand for exportables decreases causing an increase in any export taxes.
4. Decrease in the supply of nontradables as the rising price of tradables attracts resources into the production of exportables and importables and away from nontradables causing a loss in domestic consumption taxes.

A crude estimate of the FEP arising from these effects of indirect taxes can be gained from the following:

$$FEP = M/(M+X).T_m + (0.3T_m + 0.75)V$$

where:

M = Value of imports of goods and services
X = Value of exports of goods and services
T_m = Effective import duty rate, or import duties over import value of goods and services
V = Effective domestic consumption tax rate, or domestic consumption taxes over final demand

Based on revenue and macroeconomic data for India through 2004, FEP is approximately 12 percent.

Annexure 2:
Economic Discount Rate

Why is the Economic Cost of Capital Important?

Project appraisal requires a comparison of the costs and benefits of a project over its life. For acceptance, the present value of the project's benefits should exceed the present value of its costs. In the case of mutually exclusive projects, its net present value (NPV) also should be greater than those of the alternative projects.[51] The economic opportunity cost of capital is also an important parameter for taking decisions relating to the optimum size of the project and the appropriate timing for making an investment. Both are critical factors affecting the net benefits and the project's ultimate viability. In addition, the choice of technology for a project is influenced by the opportunity cost of capital. A low cost of capital will encourage the use of capital-intensive technologies as opposed to labor- or fuel- intensive technologies. In the case of the Indian states, the situation may be the other way around, where the cost of capital can be high, and therefore labor-intensive technology should be encouraged.

(i) Opportunity Cost of Capital and Investment Criteria

When the net present value (NPV) is used as an investment criterion, it is the net benefits, which occur over time that must be compared for alternative projects. As the resources available today may be used for investments, yielding positive returns, or alternatively may provide goods and alternative services for immediate consumption, it is necessary to give a greater importance to benefits and costs that accrue earlier and a lower weight to those that accrue in later periods.

In applying the NPV criterion in economic analysis, the values of net benefits should be discounted to a common point in time before comparison. This is done using the economic opportunity cost of capital as the discount rate. When this discount rate is used, a positive net present value means that the project in question has a greater economic return than would otherwise be produced by the standard alternative use of the same funds.

(ii) Choosing the Scale of a Project

An important decision in project appraisal concerns the size or scale at which a facility should be built. It is seldom that the scale of a project is constrained by technological factors, and economic considerations should be paramount in selecting its appropriate scale. Even if the project is not built to its correct size, it may be a viable project, i.e., its NPV may still be positive, but less than its potential. The NPV is maximized only when the optimum scale is chosen.

The appropriate principle to use for determining the scale of a project is to treat each incremental change in size as a project in itself. An increase in the scale of a project will require additional expenditures and will generate additional benefits. The net present value of the costs and benefits of each incremental change should be calculated by using the economic discount rate.

The NPV of each incremental project indicates by how much it increases or decreases the overall net present value of the project. This procedure is repeated until a scale is reached where the net present value of incremental benefits and costs associated with a change in

[51] M. Roemer and J.J Stern, The Appraisal of Development Projects, (New York: Praeger Publisher, Inc., 1975).

scale changes from positive to negative. When this occurs, the previous scale is the optimum size of the plant. Thus, the economic opportunity cost of capital or economic discount rate is central to the selection of the optimum scale of a project.

(iii) Timing of Investment

Another important decision to be made in project analysis relates to the appropriate time for a project to start. A project that is built too soon could result in a large amount of idle capacity. In this case, the forgone return from the use of funds elsewhere might be larger than the benefits gained in the first few years of the project's life. On the other hand, if the project is delayed too long, shortages may occur and the forgone benefits of the project will be greater than the alternative yields of the invested funds.

Whenever the project is undertaken too early or too late, its net present value will be lower than what it could have been if developed at the right time. The net present value may still be positive, but it will not be at the project's potential maximum.

The key to making a decision on this issue is whether the costs of postponement of the project are greater or smaller than the benefits of postponement. For example, in a situation where a project's potential benefits, net of operating costs, are growing as a function of calendar time but its real investment costs are the same, irrespective of the date of initiation of the project, the costs of postponement from year t to year t+1 are the economic benefits B_{t+1} forgone by delaying the project. The benefit of postponement is the economic return (r_e) that can be earned from the capital invested in its alternative use. Thus the benefit from postponement is equal to the economic opportunity cost of capital multiplied by the capital costs, $r_e \times K_t$.

A value for the economic opportunity cost of funds is essential in choosing the correct time for starting the project.

(iv) Choice of Technology

In order to be worth doing, a public sector project must have a rate of benefit of yield that is at least as large as the economic opportunity cost of capital. If this is not so, the capital would better be left to be allocated to other uses through the normal working of the capital market.

Sometimes, public sector projects face a financial cost of capital that is artificially low. This may happen when they can raise debt capital at an artificially low rate of interest because of government subsidies or guarantees. Alternatively, public sector projects may receive tax concessions from the government. In either case, the cost of capital perceived by the project will be below its economic opportunity cost.

The use of a lower financial cost of capital instead of its economic opportunity cost would create an incentive for the project managers to use production techniques that are too capital intensive, which may not be beneficial for the Indian states. The choice of an excessively capital-intensive technology would also lead to economic inefficiency because the value of the marginal product of capital in this activity is below the economic cost of capital to the country. For example, in electricity generation, using a financial cost of capital that is lower than its social cost will make capital-intensive options such as distant hydroelectric dams or

nuclear power plants more attractive than oil- or coal-fired generation plants. A correct measure of the economic opportunity cost of capital is, therefore, necessary for the right choice of technology.

This Annexure describes the methodology and provides an empirical estimation of the economic cost of capital in India. For the purpose of evaluating investment projects, this national parameter should be used to discount the net economic benefit stream arising from an investment in order to derive its economic net present value. The empirical results indicate that the real economic cost of capital is approximately 12 percent for the country. Hence, the rate of 12 percent is recommended for the economic discount rate in the Indian states.

Methodology for Estimating the Cost of Capital

Different approaches have been used to determine the economic cost of capital.[52] One of the practical ways to measure this parameter is to use the economic opportunity cost of public funds where the funds will be drawn from various sectors of the economy according to their response to changes in interest rates due to borrowing in capital markets.[53] In a developing economy like India, there are normally three alternative sources for these public funds. The first source comes from those resources that would have been invested in other investment activities, but those other activities have been either displaced or postponed. Another alternative source is from

For the purpose of evaluating investment projects, this national parameter should be used to discount the net economic benefit stream arising from an investment in order to derive its economic net present value. The empirical results indicate that the real economic cost of capital is approximately 12 percent for the country. Hence, the rate of 12 percent is recommended for the economic discount rate in the Indian states.

individual savers whose resources would have been spent on private consumption, but the consumption is forgone due to an increase in domestic savings. The third source is additional foreign capital inflows.

Based on these three alternative sources of public funds, the economic cost of capital (EOCK) can be estimated as a weighted average of the rate of return on displaced or postponed investments, the rate of time preference to savers, and the cost of additional foreign capital inflows. It can be expressed in the following form:

$$EOCK = f_1 \bullet \pi + f_2 \bullet \gamma + f_3 \bullet MC_f \qquad (1)$$

where

π = the economic cost of funds drawn from the displaced investment

γ = the rate of time preference

MC_f = the cost of foreign savings

The economic cost of funds drawn from the displaced investment (π) is measured by the forgone gross-of-tax return to domestic capital,

[52] See, for example, Sell, Axel, "Project Evaluation: An Integrated Financial and Economic Analysis" (Avebury, England 1991), Part III.3, Hirshleifer, Jack, DeHaven, James C., and Milliman, Jerome W. "Water Supply: Economics, Technology, and Policy" (Chicago: University of Chicago Press,1960) Little I.M.D. and Mirrlees J.A., "Project Appraisal and Planning for Developing Countries" (London, Heineman Educational Books Ltd., 1974).

[53] A.C. Harberger, "On Measuring the Social Opportunity Cost of Public Funds", *Project Evaluation — Collected Papers*, (Chicago: the University of Chicago Press, 1972), Chapter 4.

the rate of time preference (γ) is the cost of postponed consumption due to the response by households to save more, and the cost of foreign savings (MC_f) is valued at marginal cost of foreign borrowing by the government. The corresponding weights (f_1, f_2, and f_3) are the proportions of funds diverted or sourced from each sector, and
$f_1 + f_2 + f_3 = 1$.

These weights can be expressed in terms of elasticities of demand and supply of funds with respect to changes in financial costs or rate of return. Parameter f_1 may be shown as:

$$\frac{\eta}{\varepsilon_r(S_r/S_t)+\varepsilon_f(S_f/S_t)-\eta}$$

Parameter f_2 may be shown to be equal:

$$\frac{\varepsilon_r(S_r/S_t)}{\varepsilon_r(S_r/S_t)+\varepsilon_f(S_f/S_t)-\eta}$$

Parameter f_3 may be shown to be equal:

$$\frac{\varepsilon_f(S_f/S_t)}{\varepsilon_r(S_r/S_t)+\varepsilon_f(S_f/S_t)-\eta}$$

Where:

ε_r = the supply elasticity of household savings
ε_f = the supply elasticity of foreign funds
η = the elasticity of demand for capital relative to changes in the interest rate
S_t = the total saving available in the economy
S_r = the contribution to the total savings by households
S_f = the total contribution of net foreign capital inflows

There are more than one group of investors and savers. Therefore, the elasticities ε_r, ε_f and η used in the equation are the weighted average of elasticities for the various groups of savers and investors.

Expressing f_1, f_2, and f_3 by the weights in terms of elasticities of funds, equation (1) can then be rewritten as follows:

$$EOCK = \frac{\varepsilon_r(S_r/S_t)\bullet\gamma+\varepsilon_f(S_f/S_t)\bullet MC_f-\eta\bullet\pi}{\varepsilon_r(S_r/S_t)+\varepsilon_f(S_f/S_t)-\eta} \qquad (2)$$

Annexure 3:

Economic Opportunity Cost of Labor (EOCL)

The Economic Opportunity Cost of Labor (EOCL) is the value to the economy of the set of activities given up by the workers including the nonmarket activities (costs and benefits) associated with changes in employment due to the project. It may be noted that labor is not a homogeneous input; there are many different types of skilled and unskilled labor, with both regional variations and distinct sectors (protected and unprotected). The quality of employment opportunities (permanent and temporary) also affect the EOCL.

(A) Estimation of the Economic Opportunity Cost of Labor

There could be two alternative starting points:

i) Value of marginal product of labor foregone; and

ii) Supply price of labor.

Using either method will theoretically produce the same result; data requirements for the two approaches, however, are quite different.

(i) Value of Marginal Product of Labor Foregone Approach

In this approach, the EOCL is determined by starting with the gross-of-tax alternative wage (W_a) earned in previous employment. There are two problems with this approach.

1. Method not suited to accounting for differences in working and living conditions which do not directly reduce output in the economy.
2. When hiring unemployed labor, it may lead to underestimation of EOCL.

(ii) Supply Price of Labor Approach

The supply price of labor approach is straightforward and easy to use.

- Starting point is the gross-of-tax market wage (the supply price) required to attract sufficient workers of the required skill level to work on the project. That wage also accounts for worker's preferences for location, working conditions and other factors;
- If a very high local market wage is required to attract skilled labor to a project where the living conditions are bad, that wage already includes value of foregone wages plus the compensation needed for economic costs inflicted by the bad living conditions on the workers; and
- Supply price needs to be adjusted to account for other distortions, such as taxes, etc., to arrive at the EOCL.

Unlike the marginal product foregone which measures both these components separately, the local supply price directly measures the wage and nonwage costs of employment by the project as a combined package and that is the economic opportunity cost labor of working on the project.

Supply price determined by asking the question: What is the minimum wage the project must pay to get an adequate number of applicants with an acceptable turnover? If the number of applications per job is high, and turnover rate for the project is abnormally low, wage rate paid is most likely to be above the minimum supply price. If the ratio of qualified applicants to vacancies represents a fairly tight labor market,

and turnover rate is normal, project wage is close to supply price of labor.

EOCL is calculated by adjusting minimum supply price to account for distortions such as income taxes or subsidies.

Example 1: Comparing the Value of Marginal Product Foregone and Supply Price Methods

Consider the case of unskilled farm workers who move from their previous job of picking apples in cold, rainy apple growing region (a) to work on a new project in warmer climate (o) of harvesting oranges.

Starting point for calculating the EOCL using the marginal product foregone approach is the prior wage on the apple farms (W_a), while the supply price approach would begin with the market wage for work in the orange groves (W_o). For simplicity, assume that the workers do not pay income taxes or face any other significant distortions in their labor market. Other factors that would influence the decision to relocate to the new project are: the warmer climate of the orange growing region that might translate into a reduced cost of living (C) or a preference (S) of the workers to work in a warmer region.

If values of the wage and other factors are assumed to be as follows:

W_o = USD 15.00 per day

The Economic Opportunity Cost of Labor (EOCL) is the value to the economy of the set of activities given up by the workers including the nonmarket activities (costs and benefits) associated with changes in employment due to the project.

W_a = USD 20.00 per day
C_o = USD 3.00 per day
C_a = USD 6.00 per day
S_o = USD 2.00 per day (value of the preference for warmer region)

Marginal product foregone method to calculate EOCL for the project yields:

EOCL = prior wage - change in cost of living - worker preferences
= $W_a - (C_a - C_o) - S_o$
= 20 - (6 - 3) - 2
Or EOCL = USD 15.00 per day

With supply price approach, same value reached directly. The market wage necessary to induce workers to move to new project in orange growing region (W_o) is known and already accounts for the cost of living difference ($C_a - C_o$) and worker's preference for warmer climate (S_o). EOCL simply equal to market wage in the region of the new job:

EOCL = W_o = USD 15.00 per day

Usually, it is difficult to place values upon complex factors such as cost of living differentials and workers' preferences for living conditions, etc.

(B) Different categories of labor and accounting for these differences:

1. Type of skill: skilled, unskilled.
2. Regional Variation: rural, urban.
3. Labor market segmentation: Unprotected vs. Open.
4. Type of Job: Permanent vs. Temporary.

The unskilled labor is usually homogeneous and estimating its EOCL is quite straightforward. Normally, distortions such as taxation or unemployment insurance are absent. But the skilled labor market is much more heterogeneous and subject to multiple distortions.

Regional migration induced by differences in wages, cost of living, access to consumer goods, etc., also affects the EOCL for a project. Distortions in the economy related to that migration needs to be accounted for when estimating EOCL.

Urban labor markets are often segmented into protected (employees of SOEs, large industries or multinational corporations sectors) and those where wages are set competitively (unprotected or open sector).

Estimation of EOCL for a project also needs to consider whether permanent or temporary employment will be created. Temporary positions (tourism, construction) lead to greater turnover and create conditions for voluntary unemployment and thus causing additional costs to the economy.

II. The Economic Opportunity Cost of Unskilled Rural Labor

Supply Price Approach — Three steps are involved:

(i) Determine the minimum gross-of-tax wage (W) needed to attract sufficient unskilled labor;

(ii) Identify distortions in the labor market such as income taxes or unemployment insurance benefits; and

(iii) Determine EOCL by adjusting for distortions.

Several cases may arise in this group.

Case I: No seasonal variations in the market wage and no distortions in the unskilled labor market. It follows that supply price of labor equals the prevailing market wage (W^u). No need to make further adjustments because there are no distortions.

(1) $EOCL^u = W^u$ = Supply Price of Unskilled Labor

Case II: Estimation of EOCL of unskilled labor for a project where demand of workers is same throughout the year while the market wage varies due to external factors affecting labor market. If no tax distortions, the EOCL is the average of the monthly or weekly market wage rates (W^u_i) for the duration of the project.

(2) $$EOCL^U = \sum_{i=1}^{n} L_i W^u_i \Big/ \sum_{i=1}^{n} L_i$$

where:

n = the number of periods over which the EOCL is being estimated

i = the period of time

L_i = the number of people employed during period i.

Seasonal variations: It is quite common to have seasonal variation in the size of the employed work force in rural areas. In this case, EOCL is a <u>weighted average</u> of the different unskilled wage rates throughout the year.

This equals the sum of unskilled wage rate for each particular season or wage period (W^u_i) times the proportion (K_i) of the total amount of

unskilled labor employed by the project in that period.

As $K_i = L_i / \sum_{i=1}^{n} L_i$ (Eq. 2) can be rewritten as:

(3) $EOCL^u = \sum_{i=1}^{n} (K_i W^u_i)$

where: n = the total number of periods; i = the period of time.

Example 2: Sugar Factory Hires Unskilled Labor in a Rural Area

A labor-intensive sugar project requires unskilled workers on a temporary basis and pays a wage of 180 dollars per month (W^u_p). The working conditions are identical to those prevailing in the labor market. Table A 3.1 (column 3) shows the project's monthly requirements for person-months and in column (2) the monthly market wage rates (W^u_i) that agricultural labor would be willing to work for this project.

Monthly market wage rates are the supply prices of unskilled labor to the sugar project. Monthly shares (K_i) of the annual person-months required by the project are in column (4).

$EOCL^u = \sum_{i=1}^{12} (K_i W^u_i)$

= [120*0.2 + 100*0.2 + ... + 150*0.1 + 180*0.1]
= USD 141/month

Project wage (W^u_p) plays no role in estimation of EOCL. Wage paid by project (USD180) is a financial cost to the project, and the difference between it and EOCL (USD141) is the labor externality (USD39) which labor receives as a distributional benefit.

Table A 3.1: Annual Economic Opportunity Cost of Labor (By Calendar Month)

Month (1)	Mkt. Wage W^u_i in USD/Month (2)	Person-months Reqd. by Proj. (3)	Share of Annual Person Months (K_i) (4)
January	120	1,800	0.2
February	100	1,800	0.2
March	180	1,800	0.2
April	180	900	0.1
May	100	900	0.1
June	150	0	0.0
July	180	0	0.0
August	120	0	0.0
September	150	0	0.0
October	110	0	0.0
November	150	900	0.1
December	180	900	0.1
Total		**9,000**	**1.0**

III. Economic Opportunity Cost of Skilled Labor

Skilled workers need to be induced with higher wages to migrate from areas where they are accustomed to better amenities and living conditions. Some items such as housing and food may be cheaper in the rural areas. Thus, increase/decrease in supply price of labor as it moves from the city to countryside depends on the consumer surplus lost or gained.

Case I: Labor Market without Distortions or Regional Migration

If no distortions in the market (income tax) and if working conditions are the same, it is immaterial whether the new workers come from other employments (reduced demand) or from nonmarket activities (new supply). In both cases EOCL equals local market wage (W^s).

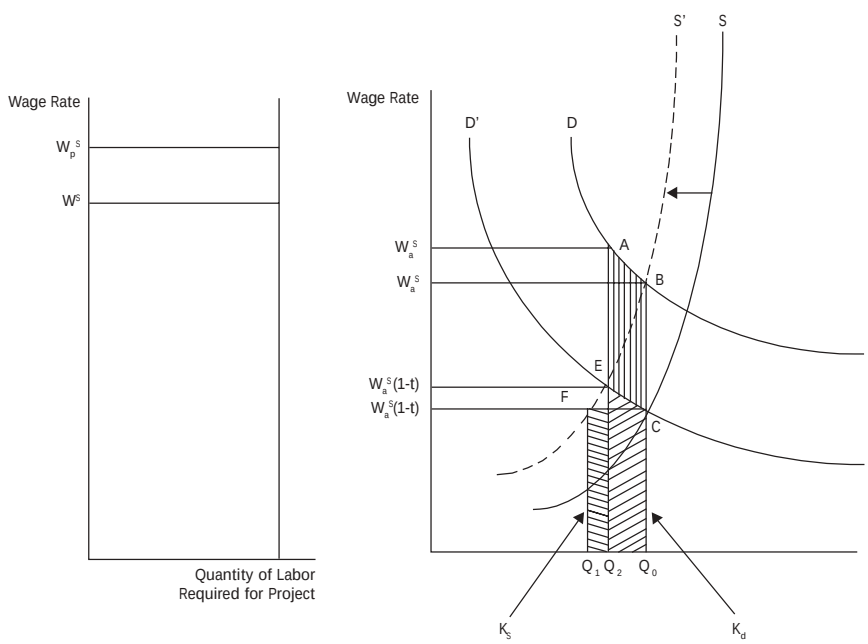
(4) $EOCL^s = W^s$

Skilled workers need to be induced with higher wages to migrate from areas where they are accustomed to better amenities and living conditions. Some items such as housing and food may be cheaper in the rural areas. Thus, increase/decrease in supply price of labor as it moves from the city to countryside depends on the consumer surplus lost or gained.

Case II: Skilled Workers Migrate to Project from Distorted Labor Markets

For each skill type the project pays a wage equal or higher than the supply price (W^s) to attract adequate numbers of skilled workers. EOCL for each type of labor equals the gross-of-tax supply price to the project of that type, less any taxes now paid by these workers on the project, plus any taxes lost due to movement of labor to project.

Figure A 3.1: Regional Interaction Between Skilled Labor Markets



Market for a Type of Skilled Labor in Sending Region

$$K_s = \frac{Q_0 - Q_1}{Q_0 - Q_1}$$

$$K_d = \frac{Q_0 - Q_2}{Q_0 - Q_1}$$

Migration of workers from other regions to the project causes labor supply (S) in the sending region to decrease, thus shifting the labor supply curve leftward to the new position S'.

At the original net-of-tax wage for skilled labor ($W^s_a(1 - t)$) in the sending region, the migration to the project causes a decrease in the available supply from Q_0 to Q_1. For equilibrium in labor market, wage must increase to $W^{s'}_a(1 - t)$. This higher wage reduces demand in the sending regions. Higher wage rates induce some skilled workers to enter the formal labor (or overtime) market increasing the quantity of skilled labor supplied from Q_1 to Q_2.

The net effect is that if all of the labor for the project migrates from the sending regions, a proportion of the labor (K_S) ultimately comes from the newly induced supply and a proportion (K_d) comes from the reduced demand for workers elsewhere.

Due to reduction in demand of labor, there is a loss of taxes to the government (area bounded by ABCE). To calculate $EOCL^S$, only the tax distortion resulting from reduced demand (K_d) is accounted for. The increased supply (K_S) of labor is coming from market or nonmarket activities where there are no taxes.

$EOCL^S$ is gross-of-tax supply price (W^s) of workers induced to move to the area minus the difference between the income taxes the workers would pay on this supply price of labor ($W^S t$) gained by government, and the income taxes previously paid by workers in their alternative employment ($K_d W^s_a t$), which are lost.

(5) $$EOCL^S = W^S - (W^S t - K_d W^s_a t)$$

where:

K_d = proportion of the project's demand for skilled labor obtained from taxed employment activities in the alternative labor market

W^s_a = gross-of-tax wage of skilled labor from alternative sources

t = income tax rate levied on skilled workers in all regions

Example 3: Skilled Labor Hired for Sugar Production Project

Going back to the example of the sugar project, if the government requires 1,000 person-months of skilled labor per year, project will normally have to attract them from the surrounding urban areas. If these workers earn a monthly gross-of-tax salary (W^s_a) of USD 900 in the urban area, they will not work for less than USD 1,200 gross-of-tax wage for the project (W^S). These wage rates reflect the gross-of-tax supply prices of the workers in the two markets. If there is a policy of encouraging more skilled workers to migrate to rural areas, project may be required to pay higher salary (W^s_p) of USD 1,500 per month, or USD 300 more than the market supply price. All skilled workers pay 20 percent of their wages in income taxes.

(1) Taxes on the Supply Price of Labor

Taxes on the supply price of skilled labor are calculated as follows:

$$\text{Taxes on Supply Price} = W^S t$$
$$= 1{,}200(0.20) = \text{USD } 240 \text{ per month}$$

(2) Taxes Foregone in Alternative Employment

Assume that $K_d = 0.90$ and $K_S = 0.10$, i.e., approximately 90 percent of the project's

skilled labor requirements will be sourced from the decrease in the quantity of labor demanded, while the remaining 10 percent will be met through increased labor force participation due to the new project's higher wage. The foregone taxes from the previous employment of the skilled workers are:

Taxes Foregone = $K_d W^s_a t$
= 0.90 * 900 * 0.20 = USD 162/month

$EOCL^s$ = $W^s - (W^s t - K_d W^s_a t)$
= 1,200 - ((1,200 * 0.20) – 162))
= (0.90 * 900 * 0.20))
= USD 1,122/month

Case III: Labor Employed Less than Full Year in Market Activities

A worker now spends part of the year in nonmarket activities. Workers are employed in market activities for a proportion (P_p) of the year if they work for the project and (assuming that $P_p \leq 1$) a different proportion (P_a) of the year if not working on the project.

When the worker is not working in the formal labor market, he is engaged in nonmarket activities outside the project or in alternative regions, (1 - P_p) and (1 - P_a) portions of their labor time, respectively.

If gross-of-tax supply price of skilled labor in the area of the project is W^S and the alternative wage (reflecting skilled labor's other opportunities) is W^s_a, the $EOCL^S$ is the gross-of-tax expected supply price for skilled labor working a portion of the year in the local market ($P_p W^S$) that would induce the worker in the project area minus the additional tax payments that the worker has to make when working on this project.

This additional tax is the difference between the tax paid on the project ($P_p W^S t$) and the tax previously paid in the alternative mix of market activities ($K_d P_a W^s_a t$). It is assumed that workers do not pay taxes on nonmarket activities.

(6) $EOCL^S = P_p W^S - (P_p W^S t - K_d P_a W^s_a t)$

Example 4: Skilled Labor Employed Less Than Full-time in Market Activities

Alternative wage rate for skilled labor is W^s_a = USD 600/mo, the project wage is equal to gross-of-tax supply price paid to induce labor to move to the project area ($W^S = W^s_p$ = USD 800/mo). The tax rate on skilled labor in all locations is 20 percent. All of the labor is obtained from alternative employment (K_d = 1), and the proportion of time a skilled worker expects to be employed is P_p = 0.9 in the project area, and P_a = 0.8 in the alternative areas.

$EOCL^S$ = 0.9(800) - (0.9(800)(0.20) - 1.0(0.8)(600)(0.20))
= 720 - (144 - 96) = USD 672/mo

While the financial cost of labor to fill a job (which employs someone for 90 percent of the year) is estimated, on the average, to be ($P_p W^s_p$) or .9(800) = USD 720 per period, we find that the economic opportunity cost of labor is only USD 672/mo, or USD 48 less than the financial cost. This difference is the net tax gain to the government.

Annexure 4:

Pro Forma for the New Projects to be Presented to EFC for Approval:

1. Name of the Administrative Department _____
2. Grant No./Account Head _____
3. Name of Plan/Project/Nonrecurring Head _____
4. Short description of the Project Giving Details of Plan, Sectoral Analysis, Objectives, and Justification _____
5. Details of Nonrecurring Expenditure _____
6. Expenditure Heads Plan/Nonplan Aided by GoI (In Percentage).

   (i) If it is a plan expenditure, justification for not including it in Centrally-aided Projects.

   (ii) Can this Project/Nonrecurring items be funded as externally aided project?

   (iii) Can this Project be implemented as a PPP venture?

   (iv) Budget Allocation in the current year for this project, if applicable.

   (v) Outlay available for the Project in Plan/Nonplan budget.

7. Proposed Financial Yearwise Allocation for the Project

Heads	Total Expenditure	1st Year	2nd Year	3rd Year	4th Year	5th Year
A. Land Acquisition						
B. Construction Work/Development Work						
C. Expected Expenditure on Staff (Including NP)						
	Total					

In the current financial year, budget for the project, complete information under various heads:

i. Expenditure that has not been examined previously by the EFC but included in the budget; and

ii. Expenditure approved by EFC, but later, due to substantial changes in scope, etc., reexamination has become necessary or the proposal has to be taken through supplementary grant. In such cases, it is necessary to inform how the additional expenditure will be revised.

(a) Land Acquisition

i. Is land identified and available? Is land acquisition required?

ii. Are there any problems in developing the selected construction site?

iii. Area of land.

iv. Is the selected land of proper size and shape?

v. Has the No Objection Certificate been taken as per the Forest Conservation Act?

vi. Are proper arrangements made for the rehabilitation of the displaced people?

vii. No. of beneficiaries (If Applicable).

(b) Construction of Building/Development Work

i.	Are specifications according to the norms of PWD?	Yes/No
ii.	Has soil testing been done?	Yes/No
iii.	Are the construction estimations according to the Carpet Area norms of PWD?	Yes/No
iv.	Are office location and office area according to norms of PWD?	Yes/No
v.	Has the certificate of load bearing capacity been taken?	Yes/No
vi.	Is the estimation based on the quality standards of PWD?	Yes/No
vii.	Is the proposed work to be completed in the form of one unit?	Yes/No
viii.	Is the layout plan based on site inspection?	Yes/No
ix.	Are architectural and design services appropriate and cost-effective? A detailed set of such drawings will be provided for implementation to the site engineer. Yes/No	
x.	Have layout plans and building designs been approved by the competent authority?	Yes/No
xi.	Have all possibilities of cost reduction been examined?	Yes/No
xii.	Is the area of land as per norms?	Yes/No
xiii.	Are the plinth area rates appropriate?	Yes/No
xiv.	Is the plinth area as per norms?	Yes/No
xv.	Has a detailed implementation schedule been prepared?	Yes/No
xvi.	Are the administrative and survey rates as per norms?	Yes/No
xvii.	Has the earthquake resistance technique been adopted?	Yes/No
xviii.	Has provision for rainwater harvesting been made?	Yes/No
xix.	Has provision been made for escalation?	Yes/No

(c) Staff Requirement

Groups	Pay Scale	1st Year No Amount	2nd year No Amount	3rd Year No Amount	4th Year No Amount	5th Year No Amount	Total Amount
		INR	INR	INR	INR	INR	INR
	Total						

- Are proposed appointments temporary or permanent?
- Please give full justification for the number of employees.
- Why this work cannot be done through outsourcing?
- In the areas, where these projects are applicable, is there any provision of staff and other facilities in plan or
  nonplan heads? If yes, then their description.
- Is there existing staff in similar projects which can be redeployed?

(ii) Details of equipment/machinery/vehicles, etc., required

Heads	1st Year	2nd Year	3rd Year	4th Year	5th Year	Total
	INR	INR	INR	INR	INR	INR
1. From India						
2. Imported						
Total						

(iii) Foreign Currency Requirement

Heads	Supplier Country of Equipment/Machines	Amount in Foreign Exchange Currency	Amount in Rupees	Availability of FE Ensured or Not

8. Production/Profit profiles of the Project.
9. Please give estimated period including details of stages and their completion dates.
10. Loan Details — Amount/ Period of Loan/Period of Moratorium/ Rate of Interest/ Annual, Half-yearly, Quarterly, Monthly repayments as per Loan Agreement and Securities given. How the resources for repayment will be generated?
11. Loan/Subsidy received from the Central Government or any other agency may be indicated year wise alongwith special levies and sanction, if any.
12. Expected revenue from the project.

Revenue Generation	1st Year	2nd Year	3rd Year	4th Year	5th Year up to 10th Year
	INR	INR	INR	INR	INR
Total					

13. Is there any project similar to the one that is proposed which is already being constructed or has been completed? If yes, give its details under sectoral analysis (item 4 above).

14. Is a Detailed Project Report ready (If yes, please enclose it)

15. When the project is being made in PPP mode.

- Detailed cost analysis of the private sector involvement to ensure that PPP enhances public benefit. Will it create efficient structure at the least cost and in the minimum time?
- Will created structure bring better value for money through involvement of the private sector?
- Does it threaten the overall responsibility of GoJ to the taxpayer for the quality of service?
- Does the arrangement allow public ownership of infrastructure and ensure adequate ROI for the entrepreneurs?
- Partnership pattern.
- Build, operate and transfer (BOT).
- Build, operate, own and transfer (BOOT).
- Build, own, lease and transfer (BOLT).
- Design, build, finance and operate (DBFO).

16. Conduct Financial, Economic and Risk Analysis as enumerated below:

Financial Analysis:

- Explain the Mode of financing — Market Borrowing/ Budget Finance/ Loan from Financial Institution/ External borrowing/ Reasons for the choice;
- What is the cost of budget funding (Cost of Budget finance could be the rate at which the Government Investment Corporations lend money to projects);
- Draw up a cash flow profile for 10 years even if the actual project life is longer;
- Land appreciation should not be included unless it is due to the project itself;
- Financial analysis must be done at nominal values since payments for debt service, taxes etc are only made in nominal rupees (after incorporating inflation). The net cash flow should then be deflated to convert it into real net cash flow (i.e., after removing the impact of inflation);

- Financial analysis should be done from different perspectives that are relevant. Every stakeholder should have some interest to keep him/her engaged in the project;
- Insist on NPV calculation instead of cost-benefit ratio or IRR;
- The financial NPV gives the value of project which is useful while considering privatization; and
- Negative annual cash flows; can these be corrected with bridge finance if needed?

Economic Analysis:

- Incorporate positive and negative externalities in the analysis;
- Economic (shadow) prices of only those variables should be calculated where market distortions are substantive (this is done by calculating the Conversion Factors);
- Secondary data may be used for Economic Analysis whenever possible;
- Economic price of a product / service tells the correct level of user fees to be charged; and
- Comparing financial and economic values gives details of the losers and gainers and by how much. If some group is gaining a lot, some of the gains should be transferred to the loser groups.

Risk Analysis:

- Based on Sensitivity Analysis, Risk Analysis is conducted using an appropriate software;
- Where contracts or agreements are arranged with suppliers, workers, managers, buyers, then the formulas reflecting these arrangements need to be incorporated into the spreadsheets so that their impact on the expected values and variability of the cash flows is seen;
- Where systemic risks and otherwise nondiversifiable risks face a project, add risk premium to discount rate to reflect cost of risk to equity holders;
- Define results;
- Set simulation runs;
- Run simulations (Desensitize sensitivity analysis before running simulation runs); and
- Interpret the Analysis/options/risk management opportunities to reduce/reallocate risks and costs.

Annexure 5:

Government Order Pro Forma

State Government
Finance Department
No. ——————
Date: ————

Office Memorandum

Concurrence is given in Finance Department on the proposals of Plans/Projects/material purchase at government level. By the office memorandum No. ———— dated ——— Expenditure Finance Committee was constituted to make the procedure of concurrence accessible, objective and analytical. In this sequence after appropriate thought one consolidated self-explanatory order is being issued hereby which will be immediately replace office memorandum — No. ——— dated

Members of the committee – following will constitute Expenditure Finance Committee: -

1. Principal Secretary, Finance/Finance Secretary - Chairman
2. Secretary, Planning - Member
3. Secretary Forest and Environment - Member
4. Secretary, Concerning Administrative Department - Member
5. Chief Engineer or and officer nominated by him who is not less than executive engineer - Member
6. Director, Planning/State Planning Commission - Convener (Project Formation and Evaluation Section) /Member
7. Engineer of Concerning Construction Agency - Special Invitee /Managing Director

For the discharge and examination of the secretarial works of the committee the required action will be taken by the Project Formation and Appraisal Division of the Planning Department.

2. Area and Duties of Committee:

(a) All such proposals where on one unit there is annual recurring expenditure of INR 50 lacs nonrecurring expenditure of INR five crores or more than INR five crores will be presented before the committee.

(b) All such schemes where the assets and investment of state government is vested and that are being made in the PPP framework will indispensably be presented before the Expenditure Finance Committee.

(c) Such proposals, where with the consultation of expenditure finance committee the concerning department has fixed standards and has fixed standards of expenditure estimate of energy construction unit and its nonrecurring expenditure is upto INR five crores. These proposals will be accepted after general examination.

(d) Normally, the examination of proposals by the Expenditure Finance Committee will be examined before their inclusion in the budget. Such proposals that have been included in the budget without being examined by the committee will be examined as per fixed procedure prior to its financial approval.

(e) If the revised estimate of nonrecurring works/schemes is 50 percent more than the original estimates then examination of the revised estimate will be done by the Expenditure Finance Committee. Those revised estimates that are less than 50 percent of the original estimates will be examined by the related Expenditure Control Section of the Finance Department as per rule. For this, the information on the enclosed pro forma will be presented before the Expenditure Finance Committee.

(f) In special conditions, the proposal not falling within the jurisdiction of the committee can be presented before the committee for examination.

Explanation

1. Unit of expenditure means such works which is proposed to be done separately in an independent manner.
2. While estimating the investment in any proposal, those related heads will also be included that will necessary for getting the proposed work done.

3. Work procedure for committee

1. Committee will convene its meetings two times in a month seeing its workload and convenience.
2. If there is a necessity to consult an officer for the deliverance of any special proposal then the committee has the right to call the concerning officer for consultation.
3. Prior to presenting the proposal before the expenditure finance committee, the Departmental Committee under the chairmanship of principal secretary/secretary of the department will first examine it. Following points will be taken into consideration for appropriate examination of plan/projects/non recurring heads by the Departmental Committee: -

   (a) Short description and introduction of the Plan/Proposal (context/background).

   (b) The problems that are to be addressed by the project. (Problems to be addressed).

   (c) Project objectives.

   (d) Target beneficiaries.

Project Strategy.
Legal Framework.
Environmental Impact Assessment.
Technological Issues.
Management Arrangements.
Means of Finance and Project Budget.
Time frame.
Financial and Economic Analysis.
Risk Analysis — only for infrastructure projects.
Evaluation.
Success Criteria.
Sustainability.

With the aforementioned description, the proposal of Departmental Committee will be presented before the Expenditure Finance Committee on the enclosed pro forma.

4. Detailed examination of all projects coming within the periphery/jurisdiction expenditure finance committee will be done by the Director (Project Formulation and Appraisal Division) and will then be presented before the committee.
5. The notes and comments on all the proposals to be discussed in the meetings of the expenditure finance committee will be made available in advance to all the members before the meetings. Those comments and notes will not be discussed that have not been distributed to the members in advance.
6. The minutes of the Expenditure Finance Committee will issued by the convener.
7. Orders from higher authorities will have to be taken according to the Rules of Business, wherever necessary, on the decisions of the committee.
8. The proposals approved by the committee will not be reexamined according to the normal procedure in the files in planning or the finance department.
9. The objections or incomplete issues concerning project should be compiled and dispatched to all the members of the committee and if there are any answers that have been received should also be made available to the members.

Principal Secretary/Secretary, Finance
Letter No. and date as mentioned above.

Copy dispatched to the following for information and necessary action.

1. Staff Officer, Chief Secretary for the perusal of Chief Secretary.
2. All Principal Secretaries/Secretaries, State Government.

3. All Departmental heads, State Government.
4. All Commissioner of State Government.
5. All District Magistrates, State Government.

Principal Secretary/Secretary, Finance

Annexure 6:

Project and Program Appraisal in the Public Sector (Financial Analysis)

Day-1

10:00 – 10:30	Opening of the Program
10:30 – 11:00	Introduction to Key Issues Affecting the Use of Project Appraisal
11:00 – 11:30	Review of Components of Project Appraisal
11:30 – 12:00	Break
12:00 – 13:30	Basics of Excel with some Applications on Excel
13:30 – 14:15	Lunch
14:15 – 15:30	Practice on Excel Worksheet Techniques
15:30 – 16:00	Break
16:00 – 17:00	Practice on Worksheet Techniques

Day-2

10:00 – 11:30	Analysis of Cash Flows
11:30 – 12:00	Break
12:00 – 13:30	An Overview of Project Appraisal
13:30 – 14:15	Lunch
14:15 – 15:30	Alternative Investment Criteria
15:30 – 16:00	Break
16:00 – 17:00	Alternative Investment Criteria — Continued

Day-3

10:00 – 11:30	Analysis of Financial Profiles from Alternative Points of View
11:30 – 12:00	Break
12:00 – 13:30	Funding of Projects (Public and Private Sector Finance for Public Purposes), Cost of Capital, Decision and Management Criteria (Debt Service Capacity Ratio, Financial Sustainability)
13:30 – 14:15	Lunch
14:15 – 15:30	Case Study 1
15:30 – 16:00	Break
16:00 – 17:00	Case Study 1 — Continued

Day-4

10:00 – 11:30	The Issues of Scale and Timing, Separable Components of Project
11:30 – 12:00	Break
12:00 – 13:30	Cost-effectiveness in Project Appraisal and Program Evaluation
13:30 – 14:15	Lunch
14:15 – 15:30	Case Study 2
15:30 – !6:00	Break
16:00 – 17:00	Case Study 2 — Continued

Day-5

10:00 – 11:30	Consistent Financial Analysis of Investments: Integration of Movements in Prices, Inflation and Exchange Rate
11:30 – 12:00	Break
12:00 – 13:30	As Above
13:30 – 14:15	Lunch
14:15 – 15:30	Presentation of Participants in Groups (Case 2)
15:30 – 16:00	Break
16:00 – 17:00	Same as Above

Day-6

10:00 – 11:30	Discussion and Future Course of Action
11:30 – 12:00	Break
12:00 – 13:30	Feedback and Evaluation
13:30 – 14:15	Lunch
14:15 – 15:30	Valedictory Function

Annexure 7:

Project and Program Appraisal in the Public Sector (Economic and Stakeholder's Analysis)

Day-1

10:00 – 11:00	Inauguration
11:00 – 11:30	Break
11:30 – 13:00	Principles of Microeconomics
13:00 – 14:00	Lunch
14:00 – 15:30	Case Study — Financial Analysis
15:30 – 15:45	Break
15:45 – 17:00	Case Study — Financial Analysis (Continued)

Day-2

10:00 – 11:30	Principles of Microeconomics (Continued)
11:30 – 11:45	Break
11:45 – 13:00	Cost-effectiveness
13:00 – 14:00	Lunch
14:00 – 15:30	Case Study — Financial Analysis (Continued)
15:30 – 15:45	Break
15:45 – 17:00	Case Study — Financial Analysis (Continued)

Day-3

10:00 – 11:30	Review of Analyses of Investment Decisions from Different Viewpoints and the three Postulates of Applied Welfare Economics
11:30 – 11:45	Break
11:45 – 13:00	Economic Prices for Traded and Nontraded Goods
13:00 – 14:00	Lunch
14:00 – 15:30	Case Study — Financial Analysis (Continued)
15:30 – 15:45	Break
15:45 – 17:00	Case Study — Financial Analysis (Continued)

Day-4

10:00 – 11:30	Economic Prices for Traded and Nontraded Goods (continued)
11:30 – 11:45	Break
11:45 – 13:00	Calculation of Conversion Factors
13:00 – 14:00	Lunch
14:00 – 15:30	Case Study — Economic Analysis
15:30 – 15:45	Break
15:45 – 17:00	Case Study — Economic Analysis (Continued)

Day-5

10:00 – 11:30	Distributional Impacts of Projects, Example
11:30 – 11:45	Break
11:45 – 13:00	Case Study — Economic Analysis (Continued)
13:00 – 14:00	Lunch
14:00 – 15:30	Case Study — Economic Analysis (Continued)
15:30 – 15:45	Break
15:45 – 17:00	Case Study — Economic Analysis (Completion)

Day-6

10:00 – 11:30	Presentation by Participants
11:30 – 11:45	Break
11:45 – 13:00	Presentation by Participants
13:00 – 14:00	Lunch
14:00 – 15:30	Feedback and Valedictory
15:30 – 15:45	High Tea and End of Program

Annexure 8:

Project and Program Appraisal in the Public Sector (Risk Analysis)

Day-1

10:00 – 11:30	Review of Financial Analysis
11:30 – 11:45	Break
11:45 – 13:00	Review of Financial Analysis (Continued)
13:00 – 14:00	Lunch
14:00 – 15:30	Practice Session
15:30 – 15:45	Break
15:45 – 17:00	Practice Session

Day-2

10:00 – 11:30	Review of Financial Analysis (Continued)
11:30 – 11:45	Break
11:45 – 13:00	Review of Financial Analysis (Continued)
13:00 – 14:00	Lunch
14:00 – 15:30	Practice Session
15:30 – 15:45	Break
15:45 – 17:00	Practice Session

Day-3

10:00 – 11:30	Review of Basic Statistical Concepts and Related Spreadsheet Functions
11:30 – 11:45	Break
11:45 – 13:00	Review of Basic Statistical Concepts and Related Spreadsheet Functions
13:00 – 14:00	Lunch
14:00 – 15:30	Practice Session
15:30 – 15:45	Break
15:45 – 17:00	Practice Session

Day-4

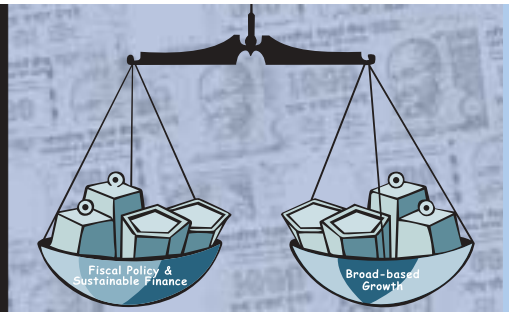
10:00 – 11:30	Introduction and Foundations of Risk Analysis and Management
11:30 – 11:45	Break
11:45 – 13:00	Risk Analysis: Sensitivity Analysis, Scenario Analysis and Monte Carlo Simulations
13:00 – 14:00	Lunch
14:00 – 15:30	Practice Session
15:30 – 15:45	Break
15:45 – 17:00	Practice Session

Day-5

10:00 – 11:30	Introduction to Crystal Ball
11:30 – 11:45	Break
11:45 – 13:00	Simple Application of Crystal Ball
13:00 – 14:00	Lunch
14:00 – 15:30	Practice Session
15:30 – 15:45	Break
15:45 – 17:00	Practice Session

Day-6

10:00 – 11:30	Project Finance Principles
11:30 – 11:45	Break
11:45 – 13:00	Feedback
13:00 – 14:00	Lunch
14:00 – 15:30	Wrap-up Session and Valedictory



Section II

Sector Guidelines and Case Studies for Project Appraisal

Introduction

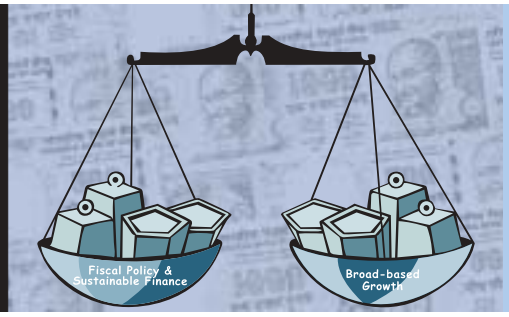
The set of sector guidelines and case studies for project appraisal cover the following sectors:

1. Electricity.
2. Road and transportation.
3. Irrigation.
4. Water supply.
5. Agricultural extension.
6. Housing.
7. Tourism.
8. Biomedical waste management.
9. Education and health.

They complement the accompanying Guidebook on project appraisal by illustrating applications of the general principles of appraisal to specific projects. With the use of the case studies, practitioners can improve the appraisal of public expenditures.

The guidelines and case studies assume that readers are conversant with the basic principles in the Guidebook on project appraisal.

For each case study, there is an Excel spreadsheet that contains the details of the analysis.



Electricity Sector

Guidelines for Electricity Sector and Estimation of Regulatory Prices

Introduction

Here two project appraisal cases drawn from studies conducted in the State of Karnataka are covered:

1. Hydroelectric power generation project: Almatti Dam Power House Project; and
2. Transmission project: 220KV Substation at HAL, Bangalore.

(a) These two cases in conjunction with: (i) The general project appraisal methodology covering the financial, economic, distributive and risk analyses of projects; and (ii) The sections covering the estimation of economic prices (or benefits) in a regulated sector in the power sector given below, give examples of the application of the project appraisal framework in the power sector in India.

The dominant feature of the electricity sector is that it is a regulated sector. Most importantly the prices received for electricity generated, transmitted or distributed to users are regulated. Estimation of the price that will be received by a project depends both on the current regulations and to some extent on predictions of the behavior of regulators and changes in regulations in response to future economic scenarios. It is clearly critical to understand whether these pricing rules and accounting conventions will actually lead to prices that cover the costs of an investment or not, for example, under different future inflation rates and costs of fuel. If the regulated price will be insufficient to cover costs, then not surprisingly investors may decline investment opportunities even though there may be excess demand for electricity supply.

Some General Principles and Considerations in Regulated Prices

A regulated price serves a number of roles. Most importantly, the price is regulated to protect the consumers by preventing the electricity suppliers from raising prices by exploiting the natural monopoly situation that arises primarily from the high fixed capital costs of the transmission system. At the same time, the regulated prices have to be sufficiently high to cover the financial costs of generation, transmission and distribution to ensure the willingness of power suppliers to investment and maintain sufficient capacity to ensure an adequate and stable supply of electricity. Basically, if market conditions do not change, a price that covers the full costs of a supplier, also allows the supplier to reinvest and maintain its productive capacity into the future.

In the case of a vertically disaggregated or unbundled system, three regulated prices need to be established that have to cover the costs of distribution, transmission and generation. In a simple world of only one type of consumer and one type of producer, just three prices are required such that:

$$p_{Rconsumer} - \text{unit cost of distribution} = p_{Rtransmission} + p_{Rgeneration} \quad (Z.1)$$

The distribution company collects $p_{Rconsumer}$ from the user out of which it has to cover its own costs as well as pay for the generation ($p_{Rgeneration}$) and transmission ($p_{Rtransmission}$) of the electrical energy it sells. If different prices are paid to different power generators, then a weighted average price of generation (wt. av. $p_{Rgeneration}$) needs to be covered. Furthermore, if different prices are

charged to different user segments (such industrial, residential and agricultural users) and also within some of these market segments — for example, a low price may be charged for an initial number of units used in each billing period — then the distributor receives a weighted average consumer price (wt. av. $p_{Rconsumer}$) from its consumers. Now, it is possible that some of the lower prices charged may not cover the combined costs of distribution, transmission and generation. Unless some users are charged prices above these combined costs (or these users are implicitly taxed), the weighted average consumer price (wt. av. $p_{Rconsumer}$) will fall below the combined cost of supply.[54] In this case the government needs to provide some form of subsidy or transfer to the distribution company to make up the shortfall in revenues. Hence, the accounting balance in (Z.1) needs to be expanded to:

$$\text{wt.av.}p_{Rconsumer} - \text{unit cost of distribution} + \text{government transfer} = p_{Rtransmission} + \text{wt.av.}p_{Rgeneration} \qquad \text{(Z.2)}$$

From (Z.2) it is evident that any price increase by power generators, such as arising from a fuel price increase, has to be absorbed by either an added government transfer or a consumer price increase. In the short run, typically government subsidies are based on the energy delivered to target groups. Such targeted consumption-based subsidies, however, may not close the financing gap. Any failure to collect the consumer revenues through lack of metering power consumption, power theft or default in payments, and any abnormally high transmission losses in the short run have to be made up by higher average consumer prices. In the long run, if consumer prices are not raised or cost efficiencies not implemented, then short falls may have to be met by added government transfers. For the distribution company the risk of failure to collect or late collection of revenues from users or subsidies from the government is an obvious source of financial risk.

The dominant feature of the electricity sector is that it is a regulated sector. Most importantly the prices received for electricity generated, transmitted or distributed to users are regulated. Estimation of the price that will be received by a project depends both on the current regulations and to some extent on predictions of the behavior of regulators and changes in regulations in response to future economic scenarios.

One simple and accurate way of determining a tariff that covers the costs of supply is to estimate the **levelized tariff** using the discounted cash flow methods, as presented in the financial analysis sections above. A levelized tariff is the uniform nominal tariff that would be paid over the term of an agreement (or life of a project) that covers the costs of the project. This tariff is estimated as the constant nominal tariff that if paid for the expected units supplied will result in a net present value of zero to the equity holders of the project when estimated at the required nominal rate of return on capital (e^n = 14 percent, say, as currently offered in India). In other words, the present value of the expected revenues gained from this tariff will just cover the present value of the costs of the equity holders (including a 14 percent return on

[54] For example, in Karnataka, some 12 different types of user are recognized that are charged different prices per kWh used. At the low end of the prices are agricultural and low-income domestic users receiving subsidies of over 80 percent of the cost, while commercial users pay about 70 percent higher than cost. See Table 4 of the following Part.

equity). Accordingly, a **levelized tariff (T^n)** is estimated as:

T^n = (Present value of nominal cash flow costs at e^n)/(Present value of quantities at $\mathbf{e^n}$) (Z.3)[55]

If instead of a uniform nominal tariff, an indexed tariff is offered, then the tariff will start at a lower level, but rise over the term of the agreement or life of the project in line with the price index. If, for example, the **tariff is indexed to inflation,** and $\mathbf{T_1}$ is the tariff that is offered in the first year of supply, then T_1 is estimated as:

T_1 = (Present value of nominal cash flow costs at e^n)/(Present value of quantities at **e**) (Z.4)

where: $e = [(1+e^n)/(1+\pi)] -1 \approx e^n-\pi$ = real return on equity given an expected inflation rate of π

An alternative method of estimating a levelized tariff is to use the accrued costs estimated on a current market value basis expected in each year of the project. While the nature of such accrued costs is discussed further below, it can be shown that these provide the same estimate as using discounted cash flow costs as presented in (Z.3/4), that is:

T^n = (Present value of accrued costs at e^n)/(Present value of quantities at e^n) (Z.5)

It is important to note that many observed appraisals of electricity generation plants tend to estimate levelized tariffs based on the annual accrued costs, but unfortunately do not adjust costs to their current market values or do not use the present value of the quantities of energy expected to be delivered. Some will merely calculate simple averages of the annual accrued historical unit costs over the life of the project.

An alternative approach to the constant or indexed levelized tariff applied over the life of the project or agreement is for the regulator to adjust tariffs based on year-to-year changes in accrued costs. As noted above, the appropriateness of this method depends on the accounting conventions used. To illustrate the difference in tariffs that would be offered, three methods of setting annual tariffs can be compared: (i) Accrued costs at current market values (AC_t); (ii) Accrued historical costs (AHC_t); and (iii) Accrued historical costs with cost of equity fixed at its original value. As noted above, the accrued cost method based on current market values gives the true cost and the same result as using discounted cash flows to estimate costs. This method becomes the base line for comparisons.

In an Annexure to this Part, expressions to estimate and compare these three approaches are derived and compared. Here the three cost approaches are illustrated and compared for an investment that is largely fixed costs (as is the case with hydro, wind and solar generation and transmission projects). With high fixed costs, differences in the costing of the capital over the project life leads to large differences in tariffs offered.

[55] Present value of the nominal cash costs discounted by the nominal discount rate for equity could be replaced by the present value of the real cash flows discounted by the real discount rate, as the two present values are equal.

Regulated Tariffs in India: Current and Emerging Methods of Cost Estimation and Adjustment

Normative Historical Cost-based Tariff

Over recent years, the basic method for establishing tariff for power generation and transmission has been the normative historical cost-plus based approach as laid out in the regulations issued by the Central Electricity Regulatory Commission (CERC) in 2004. These lay out the procedure for estimating the accrued costs expected in each future year from the beginning of operations based on a mix of actual historical costs and cost norms. Currently, they limit (or offer) a nominal rate of return of 14 percent on the original equity invested up to a maximum of 30 percent of the total financing. The annual tariff is composed of two parts: (i) A fixed or capacity charge, which assumes a minimum availability of installed capacity (for example, 80 percent for thermal plants, 90 percent for run-of-the-river hydroelectric plants, 85 percent for storage dam-based hydroelectric plants, and 98 percent for transmission capacity); and (ii) A variable or energy charge. If a power purchase agreement contains a lower capacity charge than would be obtained from application of the tariff regulations, then this lower agreed charge is applied. The formula for the annual tariff in any year t of operations can be summarized by:

$$(K_0 - L_0)\delta + (E_t - D_{Rt})e^R + (D_t + D_{Rt})i^n + WC_t\, i^{WC} + O\&M_0 (1+ g_{O\&M})^t + \text{Income Tax} + REC_t * Q_t$$

The elements of the estimated capacity and energy costs are as follows:

Fixed or Capacity Charge

1. **Depreciation charge** of $(K_0 - L_0)\delta$, where K_0 is the historical cost of 90 percent of all fixed capital assets of the power company reduced by L_0, the historical cost of land, and d is the straight-line depreciation rate for acquired assets. Asset lives for different asset types are prescribed. The remaining balance of 10 percent of the asset value can be depreciated once the loans have been paid off over the remaining useful life of the assets. In addition, an Advance Against Depreciation (AAD) is allowed where AAD equals the loan repayment amount subject to a ceiling of 1/10th of loan amount less depreciation. This advance is permissible only if the cumulative repayment up to a year exceeds the cumulative depreciation up to that year.
2. **Return on equity** investment of e^R = 14 percent is paid on the original paid up equity amount up to a maximum of 30 percent of the total capital financed. Essentially, the amount of equity, $E_t = E_0$ except where the value of foreign equity changes with fluctuations in the exchange rate. Where the amount of equity exceeds 30 percent of the total capital, the excess is taken as a notional loan, D_{Rt} that earns the average rate of interest on the portfolio of loans (i^n) rather than the regulated return on equity (e^R).
3. **Interest expense on debt** is the actual annual cost of the interest charges on the portfolio of debts ($D_t\, i^n$). In addition, where a notional loan is established for the equity in excess of 30 percent, the average interest rate on the portfolio of loans is charged on this amount ($D_{Rt}\, i^n$). Short-term interest charges are disallowed, but covered by a working capital charge.

4. **Working capital** (WC_t) is charged at the short-term interest rate (i^{WC}) set at the prime lending rate of the State Bank of India. The amount of working capital allowed is based on two months of receivables, one month of O&M charges, spares based on 1 percent of investment costs (1.5 percent for transmission companies) and increased by 6 percent per annum, and the cost of fuel inventories as prescribed for each fuel-type.
5. **Operation and maintenance (O&M) charges** are prescribed for different types and sizes of thermal plant and 1.5 percent of investment costs for hydroelectric plants. O&M charges are escalated at an annual rate ($g_{O\&M}$) of 4 percent.
6. **Income taxes** paid by the company can be charged and passed through to the distributor. Currently, power generation investments qualify for a 10-year tax holiday under the Income Tax Act.

Variable or Energy Charge

The energy charge for different types of thermal charge is the **Rate of Energy Charge (REC_t in INR/kWh)** multiplied by the **scheduled quantity of energy** for the year **(Q_t in kWh per year)**. The **Rate of Energy Charge** is determined for each type of primary and secondary fuel by:

REC_t = [fuel price (Rs/Kg or l)/**calorific value of fuel** (Kcal/Kg or l)
*** heat rate of plant** (Kcal/kWh) **] /(1- share of auxiliary energy),**

where norms are specified for the heat rate and share of auxiliary energy required for each type of plant and fuel. Auxiliary energy requirements are in the 7 percent to 11 percent range for thermal plants and about 1 percent for hydroelectric plants.

In addition to the payment of capacity and energy charges for delivering energy to meet the capacity availability targets, incentive payments are provided for plant load factors achieved above the target. For thermal plants an incentive of INR 0.25 per kWh of scheduled energy provided above the target, and for hydroelectric plants, an incentive of 65 percent of the capacity charge for the excess of the achieved capacity index over the normative capacity index (up to a maximum of 100 percent.) For transmission companies, an incentive is provided that is given in proportion to the relative excess of available capacity achieved to target capacity up to 99.75 percent capacity achieved. Power companies with declared capacity below target are penalized.

Economic Externalities from Added Electricity Supplied

Based on the nature of the regulation of a power generator, the discussion above allows the profile of the financial price ($p_{Rgeneration}$) and revenues of a new power generation project to be determined. The added supply of electricity by the project is sold typically into a regulated market subject to shortages and power rationing. In addition, certain segments of the market may be receiving electricity at subsidized prices. Over and above the price paid to the generator as shown in Z.2, a fee ($p_{Rtransmission}$) also has to be paid to the power transmission company. This fee may or may not cover the economic costs of transmission. Given these down-stream market circumstances, external costs and benefits may be generated in the transmission and consumption of the added

power supplied that need to be captured in the economic benefits attributable to the new power generation project. In addition, transmission and distribution losses result in less power actually reaching the consumer that is delivered by a generating company to the grid. For example, if a power company delivers Q_t kWh of electric energy in year t, the consumers receive λQ_t kWh of electric energy in year t, where λ is the rate of transmission and distribution losses, 15 percent say.

If a project is expected to deliver Q_t kWh of electric energy in year t, then the distribution of the sales of λQ_t kWh across different market segments (λQ_{tj}) allows the estimation of the externalities in the market segments to be determined. Three externalities need to be included: (i) The added consumers' surplus captured by the users of the electricity. As discussed earlier, in quantity rationed market segment, this externality would amount to $Q_{tj}[½(p_{MAXj} - p_{Rconsumerj})]$ where p_{MAXj} is the maximum price consumers in market segment j are willing to pay for electricity; (ii) The negative externality of any subsidy (sj) paid per unit consumed in market segment j, which would amount to (Q_{tj} s_j); and (iii) The economic costs of transmission ($c_{transmission}$) of the added energy supplied may either exceed the transmission fee ($p_{Rtransmission}$) resulting in negative externality Q_t ($p_{Rtransmission}$ - $c_{transmission}$) or be lower than the transmission fee resulting in a positive externality. These three externalities are added to the generation project financial revenues (Q_t $p_{Rgeneration}$). The combined externalities in year t amount to:

$$\Sigma_j [Q_{tj}\ ½(p_{MAXj} - p_{Rconsumerj}) - Q_{tj}\ s_j] + ?Q_t\ (p_{Rtransmission} - c_{transmission}) \qquad (Z.6)$$

Almatti Dam Powerhouse Project

Background

There are many thermal power projects coming up in the State. After completion of these thermal projects, which act as base load stations, it is important to add additional hydropower capacity to support the peaking demands. Almatti dam powerhouse with the backing of a large storage reservoir and assured downstream releases will help to meet the energy demand of the State to some extent.

The project is an offshoot of the multipurpose Upper Krishna Project located in Bagalkot Taluk of Karnataka. The project will harness the abundance of River Krishna to provide cost-effective electricity to the people of the State. Government of Karnataka withdrew the Power Project allotted to an Independent Power Producer — The Asia Power Co. Ltd. (TAPCO) and reallotted the same to KPCL for implementation, as the project costs by the IPP were high. Almatti Dam Powerhouse Project has powerhouse constructed at the foot of the Almatti dam to utilize the consumptive releases to Narayanapur dam and also surplus releases from Almatti dam during monsoon months for power generation. All environmental and ecological safeguards have been complied with in implementation of the irrigation project. The scheme utilizes penstocks that are already embedded in the body of the dam by construction of a dam powerhouse to house 5 units of 55 MWs and one smaller unit of 15 MWs totaling 290MWs. At 90 percent dependable energy, the project can generate 499MU till the full development of irrigation and 301MU after the full development of irrigation from a very clean and environment friendly source.

Financing of the Project

The total cost of the project is INR 531 crores and including IDC and escalation works, the cost works out to INR 714.93 crores **and the real televised tariff works out to INR 3.17 per unit.** The water after power generation will be led back to river Krishna through a short tailrace channel. The CEA has cleared the project technoeconomically in February 2002.

The first unit of 15MW was completed in a period of 26 months and the second unit of 55MW was commissioned in November 2004. The other four units of 55MW each were commissioned in January 2005, March 2005, July 2005 and August 2005 respectively. To shorten the time, erection of two units was tackled simultaneously. The financing was done based on debt: equity ratio of 4:1. The loan component will be INR 571.94 crores. This loan will be drawn in three installments. The interest rate of the loan is 15 percent with 1 percent guarantee commission charges on outstanding loan. The loan will be repaid in 10 equal consecutive installments starting at the end of the 2nd year of power generation.

Capital Investment Requirement of the Project

Land: KPCL will receive the land at no cost. Only 45 hectares of land for locating the permanent quarters that are required for the maintenance of the powerhouse are taken from the government at the prevailing market rate of INR 50000 per hectare.

Preliminary and Civil Works: The total capital cost for preliminary and civil works amounts to INR 175.98 crores. This amount includes the construction cost of the plant building, the cost of storage facility, the cost of construction of road, residential colony, the consultant service, and the cost of a water supply system and other

auxiliary infrastructure.

Electrical and Mechanical Equipment: The total capital cost for electrical and mechanical equipment amounts to INR 350.06 crores. This amount includes the cost of fabrication and erection of all six penstock gates, hydraulic hoist, erection of moving gantry cranes for operating penstock, draft tube gates, trash rack panels, penstock stop log gate etc, generator transformers, station transformers, auxiliary transformers, electrical system equipment, station lighting system and electrical workshop, control cables, relay panels, spares and switchyard.

Other Expenses: INR 38.93 crores are provided for establishment, support services, preoperative expenses and consultancy fees. An amount of INR 148.54 crores has been provided for escalation and interest during construction.

Operating Expenses and Working Capital for the Project

Annual Operation and Maintenance (O&M) will be 1.5 percent of total investment cost (excluding land).

Accounts receivable will be 16.67 percent of the sales revenue; and accounts payable, and cash balances will respectively be 8.33 percent and 7.5 percent of the recurring costs/operating expenses.

The financial analysis is conducted both from the total investment and equity points of view. The analysis of the project from the total investment point of looks at the overall financial feasibility of the project. Unlike the equity point of view, it does not include the loan and loan repayments as cash inflows and outflows respectively.

Economic Life, Plant Load Factor, and Auxiliary Consumption

The economic life of the plant is 35 years. The plant comprises one generating set of 15 MW and five generating sets of 55 MW each.

The annual plant load factor (i.e., the rate at which electricity is actually or effectively produced) will be
22 percent.

The annual auxiliary electricity consumption (i.e., own consumption of the power plant) will be 1 percent of effective electricity generated.

Straight-line depreciation method will be used in determining the liquidation value of the plant (inclusive of consultancy fees), assuming no major capital replacements for the duration of the project. The project will be evaluated for an operating life of 15 years; assets will be liquidated at their book value at the end of year 18.

Financial Analysis

Assumptions — The financial viability of the project is calculated from the equity and total investment points of view. The parameters used to develop the cash flow statements in the deterministic base case are appended.

Domestic Sales — In view of scarcity of electricity in the State, it is assumed that all electricity generated will be used by the consumers.

Corporate Income Tax — The Company starts paying income tax in 11th year and income tax is levied at a rate of 35 percent.

Project Life — The project has an estimated economic life of 35 years.

Project's Liquidation value — Salvage value is estimated at 10 percent of the original acquisition cost.

Inflation — The annual inflation rate has been taken as 7 percent.

Working Capital — Assumptions about inventories, levels of accounts receivable, payable, and cash balance, and preoperating costs are detailed in the table of parameters.

Methodology — The financial analysis is conducted both from the total investment and equity points of view. The analysis of the project from the total investment point of looks at the overall financial feasibility of the project. Unlike the equity point of view, it does not include the loan and loan repayments as cash inflows and outflows respectively. However, as the project financing is not subsidized, the net present value from the total investment point of view and from the equity point of view is the same (INR 369 lakhs).

The pro forma cash flow statement from the total investment point of view is first developed in nominal terms in order to take into account the effects of inflation. The cash flows are then deflated to arrive at their real values. Finally, the real net cash flows are discounted by the real overall cost of capital of 8.41 percent to get the net present value cash flow profile from the equity point of view is obtained by adding the debt cash flow to the net cash flow from the total investment point of view. The NPV in both the cases works out to INR 369 lakhs.

Sensitivity Analysis

The sensitivity analysis on different parameters has been conducted and is placed below:

Price of Electricity	
	369
2.5	185
2.7	240
2.9	295
3.10	350
3.17	**369**
3.3	405
3.5	460
3.7	515
3.9	570
1.83	**0**

Rate of Interest	
	369
7.50%	392
8.00%	380
8.41%	**369**
9.00%	354
9.50%	341
10.00%	327
10.50%	314
11.00%	300
12.00%	272
13.00%	243

O & M Expenses	
	369
0.90%	390
1.10%	383
1.30%	376
1.50%	369
1.70%	362
1.90%	355
2.10%	349
2.30%	342
2.50%	335
2.70%	328

Plant Load Factor % (Utilization)	
	369
12.7%	1
16.0%	132
19.0%	250
22.0%	369
25.0%	488
28.0%	607
31.0%	726
34.0%	844
37.0%	963
40.0%	1082

Cost Overrun Factor	
	369
0.70	504
0.80	459
0.90	414
1.00	369
1.10	324
1.20	279
1.20	279
1.40	189
1.50	144
1.60	99

The sensitivity analysis helps in identifying the risk variables.

Results of Financial Analysis

The NPV of the project (both from total investment point and owner's point of view) is positive at 369. The NPV is very much sensitive to the price of electricity and sensitive to rate of interest. NPV is zero for the real price of electricity equal to INR 1.83/unit.

Economic Analysis

For the construction of economic resource flow, the first thing we have to do is to calculate the conversion factors of various line items of financial cash flow. Following data is essential for the calculation of conversion factors (CFs):

- Economic rate of discount;
- Foreign exchange premium;
- Trade Tax/VAT;
- Rate of excise duty;
- Percentage of transportation and handling charges;
- Foreign exchange component of transportation and handling charges;
- Elasticity of supply for nontradable goods; and
- Elasticity of demand for nontradable goods.

Based on these, conversion factors have been calculated and the calculation is placed at the Excel Workbook.

The CF on power supply is taken as 1.0. Importantly, no net external benefits or costs to the consumers of the added electrical energy are included. Given the undersupply of power in Karnataka resulting in load shedding and power rationing, the additional power supply is expected to relax the power rationing, and hence, power users would capture added consumer surplus. Added indirect taxes would also be captured on the taxed final consumption of the added power used. At the same time, it is also assumed that none of the added power is supplied to subsidized users, which would result in a negative externality equal to the added power subsidy payments that would need to be made by the government.

The respective conversion factors are multiplied by the line items of financial cash flow (TIP) in order to get the economic resource flow. The net economic resource flow is discounted at the economic rate of discount (12 percent real) and we get an economic NPV of INR 260 lakhs.

Distributive Analysis

In distributive analysis the gains and losses to various stakeholders are derived from present value of economic resources minus present value of financial resources. The resulting numbers show who benefits and who loses from the project. For doing it, we subtract each line item of financial cash flow (TIP) from respective line item of economic resource flow. The each line, thus obtained, is discounted by economic rate of discount to know that who gains or who looses from this project. In this project, the externalities on the use of resources accrue to the government.

NPV externalities @ economic rate of discount: INR 78 lakhs accrues to government

But the government forgoes externalities on the

use of capital in the project equal to the (NPV of financial cash flows @ economic discount rate – NPV of financial cash flows @ financial discount rate) = - INR 187 lakhs
As a result, the net externality accruing to the government = - INR 109 lakhs (-187 + 78)
When the net externality suffered by the government (-109) is added to the gain of the project sponsor, KPCL (369), the net gain to the economy is INR 260 lakhs

Risk Analysis

Risk Analysis has been done using the application software "Crystal Ball". The detailed risk analysis is placed at the Excel Work Book. The number of Monte Carlo Simulation was taken as 75000 and the following assumptions were taken:

- Assumptions : Risk Variables - 5:
  - Operation and Maintenance;
  - Cost Overrun Factor;
  - Financial Price of Electricity;
  - Plant Load Factor (Utilization); and
  - Rate of Interest on Loan (Real).
- Correlations - 2
  - Cost Overrun Related with Financial Price of Electricity: **+0.80**.
  - Plant Load Factor with Financial Price of Electricity: **-0.50**.
- Forecasts - 2

Results

NPV Financial Base Case is 369

- Range is from 52 to 1192
- Mean is 503
- Standard Deviation is 184

NPV Economic Base Case is 260

- Range is from 131 to 1350
- Mean is 606
- Standard Deviation is 193

Mean NPV is higher for simulations without correlation as compared to with correlation

Conclusions

NPV is Positive

a) Cost of the project has come down from INR 1470 crores (Asia Power Co.) to INR 715 crores (KPCL).

b) Regulated prices are in the same range as the cost of electricity fixed for the project
   - Further gain in the project on account of cost savings of > 20 percent.
   - NPV Economic is positive because economic prices of cost items are less than their financial values (CFs < 1).
   - No adverse environment impact on account of project.
   - Govt. gains because of taxes on resources used, but loses on capital employed in project with a net tax loss.
   - KPCL captures bulk of net economic gains.
   - Existing consumers do not see a fall in the prices from the project, but should have added supply and reduced rationing of power supply. The consumer surplus gains to consumers have not been included, but

potential losses from added electricity subsidies have also not been included.

- But, new consumers will benefit because they get electricity at regulated prices.

The project is financially as well as economically viable with high Net Present Value. The risk factors of the project are minimal and the project is viable for implementation.

Please see accompanying spreadsheet model.

220kV Substation at Hal, Bangalore

Introduction

220kV HAL substation has been proposed to meet increasing demand from the consumers and relieve overloading on the existing 66kV lines. The proposed station is located close to Hindustan Aeronautics Ltd. a public sector entity. Main load centers include the commercial hub of Bangalore (M.G. Road, Commercial Road etc.,), PSU's, and residential consumers

Project Details

The project is divided into six schemes:

(INR in Lakhs)

Scheme 1	Construction of 220kV D/C line from Hoody to Hal	299.69
Scheme 2	Rerouting 66kV ADE line	8.73
Scheme 3	66kV UG cable upto DRDO complex	555.87
Scheme 4	66kV UG cable interlinking line	122.74
Scheme 5	220/66kV substation	1493.19
Scheme 6	220kV Terminal Bay at Hoody	177.38

Total Project Cost: INR 2657.61 Lakhs

Technical Details

Installed Capacity	20MVA
Load Growth	8%
Maximum Energy Sold/annum @ 0.9 pf & 65% Load Factor	1025 MU
Energy Saving	15.29 MU
Capacity Utilization at the beginning of the project	60.00%

Assumptions

Staff	Nos	Salary/month (INR)
Senior Engineer	1	30000
Engineers	5	20000
Junior Engineers	4	15000
Technicians	6	10000
Helpers	4	7000

Assumptions (Financial)

Equity Rate	14% 9%	Nominal Real
Loan	90%	2391.85 INR Lakhs
Foreign Component	30%	15.95 USD Lakh
Rate of Interest		0.98% (Nominal) (Real)
Domestic Component	70%	1674.29 INR Lakhs
Rate of Interest		8.0% (Nominal) (Real)
Grace period		1 Year
Installments		8 Annual Instalments

Inflation and Exchange Rates

Domestic Inflation Rate	5%
Foreign Inflation Rate (USA)	3%
INR / USD	45.00
Depreciation of the asset	3.33%

Project Analysis

The project was analyzed from two perspectives:

Perspective 1: KPTCL owing, investing and operating the project

KPTCL gains from energy saving from reduced transmission losses on compared to the existing transmission system and from the added energy sales from the expanded capacity.

Perspective 2: A private entity would invest on the project and collect the transmission charges (BOO Project)

The BOO company earns a transmission fee for all the energy transmitted by the new more efficient transmission system.

Perspective 1: KPTCL owing the project and making the investment

Tariff Assumption
Energy charges: INR 3.67/Unit
Added transmission charges: INR 0.035 per kWh
Growth in the energy charges: 2 percent
NPV of the Project
NPV to equity at 8.6 percent real (14 percent nominal) = INR 80.2 million
Real rate of return on equity = 29.4 percent

NPV is sensitive to inflation rate, growth in energy tariffs, transmission tariff, energy savings, and debt financing leverage. NPV breaks even (drops to zero) if inflation exceeds 16 percent and energy savings fall below 12 MUs.

Perspective 2: A private entity would invest on the project and collect the transmission charges (BOO Project)

Tariff Assumptions:
Transmission charges: INR 0.075/Unit
Energy charges: INR 3.67/Unit
Growth in the energy charges: 2 percent

NPV of the Project:
NPV to equity at 8.6 percent real (14 percent nominal) = INR 59.6 million
Real rate of return on equity = 11.6 percent

NPV is sensitive to inflation rate, growth in energy tariffs, transmission tariff, and debt financing leverage. NPV breaks even (drops to zero) if inflation exceeds 16 percent and transmission tariffs fall below INR 0.065 per kWh.

Note: Since the saving in losses would not accrue to the new entity as the saving in losses is on the KPTCL system and hence, energy charges for saving in losses is taken as zero but auxiliary consumption of the station is charged at cost of supply.

Table 3: Investment Schemes

	Financial Value	Tax	Econ. Value	Conversion Factor
Material Cost	1900.00	4%	1827	0.961538462
Spares	57.00	4%	55	0.961538462
Transport and Ins.	78.28	12.50	70	0.888888889
Labor Charges	100.50	25%	80	0.8
Commissioning	15.20	13%	14	0.888888889
Service Tax	7.24		0	0
Civil Engg. Charges	206.90	12.5	184	0.888888889
Work Contract Tax	2.69		0	0
Total Works Costs	2367.81		2229	0.941435023
Establishment Charges	118.39	30.60	91	0.765696784
Performance	2.37	0	2	1
Contingencies	41.83	0	42	1
Tree Cut and Road Cutting	20.00	0	20	1
Statutory Charges	5.00	3	0	0
Total	2555.39		2384	0.932922344
IDC	102.22		0	0
Grand Total Total Project	**2657.61**		**2384**	**0.897040715**

Economic Analysis

Conversion Factors

Consumer surplus gain from incremental energy supplied resulting in reduced energy rationing = INR 1.80 per kWh

Table 4: Conversion Factor

	Salary/ month	% Tax	Economic Value	Conversion Factor
Senior Engineer	30000	30.60%	22971	0.765696784
Engineers	100000	30.60%	76570	0.765696784
Junior Engineers	60000	25%	48000	0.8
Technicians	60000	20.20%	49917	0.831946755
Helpers	28000	20.20%	23295	0.831946755
Total Salary	**278000**		**220752**	**0.79407157**

Economic NPV

NPV to economy at 12 percent real = INR 2,343.2 million
Real rate of return to economy = 77.3 percent

Stakeholder Analysis

Risk Analysis

PV (Externalities) at econ rate	2,385,604,295				
	A				
Consistency Check					
NPV (Financial) at econ rate	-42,452,184				
	B				
PV (Externalities) at econ rate	2,385,604,295				
	A				
NPV (Financial) at econ rate = PV (Externalities) at econ rate	2,343,152,112	=	NPV (Economic) at econ rate		
	C				
		=	NPV (Financial) at fin rate = (NPV (Financial) at econ rate-		
			NPV (Financial) at fin rate = PV (Financial) at econ rate		
		=	80,181,083	+	-122,633,267
			D		E = B - D
Distributional analysis				+	2,385,604,295
					A
Gain in consumer surplus	2,359,604,231				
	F				
Change in government revenue from project operations	26,000,065				
	G				
PV (Externalities at econ rate		2,385,604,295			
		A = F + G			
Change in government revenue from capital investment	-122,633,267				
	E				
Change in government revenue (overall)		-96,633,202			
		G + E			
Gain to owners of investment	80,181,083				
	D				
NPV (Economic) at econ rate	2,343,152,112				
	C = F + G + E + D				

The project is subjected to detailed analysis for the expected variability of the key variables. The main aim of this analysis is to find out the variability of the NPV for probabilistic changes in key variables if for the case of the project undertaken by KPTCL.

The analysis is carried out with Monte Carlo method using crystal ball software.

Key Variables

Growth in Energy Charges

The Growth in energy charges is considered the **normal distribution** with a

Mean 2.00%
Std. Dev 0.12%
Correlated with load growth 0.2
Correlated with inflation 0.5

Load Growth

The Load Growth is considered the **normal distribution** with a

Mean 8.00%
Std. Dev - 0.54%

Inflation

The inflation is considered as the **triangular distribution** with a

Minimum 3.5%
Likeliest 5%
Maximum 8%

Foreign Exchange

The foreign exchange is considered as the **triangular distribution** with a

Minimum INR 41 per USD
Likeliest INR 45
Maximum INR 49.5
Correlated with inflation 0.7

Results without Correlations

NPV to equity

Mean	INR 75.3 million
Std Dev	INR 9.7 million
Minimum	INR 50.1 million
Maximum	INR 98.9 million

NPV to economy

Mean	INR 2,390.4 million
Std Dev	INR 143.2 million
Minimum	INR 1,901.6 million
Maximum	INR 2,910.8 million

Results with correlations

NPV to equity

Mean	INR 75.1 million
Std Dev	INR 9.0 million
Minimum	INR 52.2 million
Maximum	INR 97.4 million

NPV to economy

Mean	INR 2,391.1 million
Std Dev	INR 143.3 million
Minimum	INR 138.3 million
Maximum	INR 2,841.4 million

In summary, from both equity holders perspective and economic perspective there is no probability of negative NPV. The standard deviations of the NPVs are also relatively small compared to the expected or mean values of the NPVs.

Critical Summary Analysis

- The project is financially viable for investment by KPTCL with positive NPV and no probability of negative NPV. This assumes KPTLC earns INR 0.035 per kWh on the incremental energy transmitted.

Figure 1

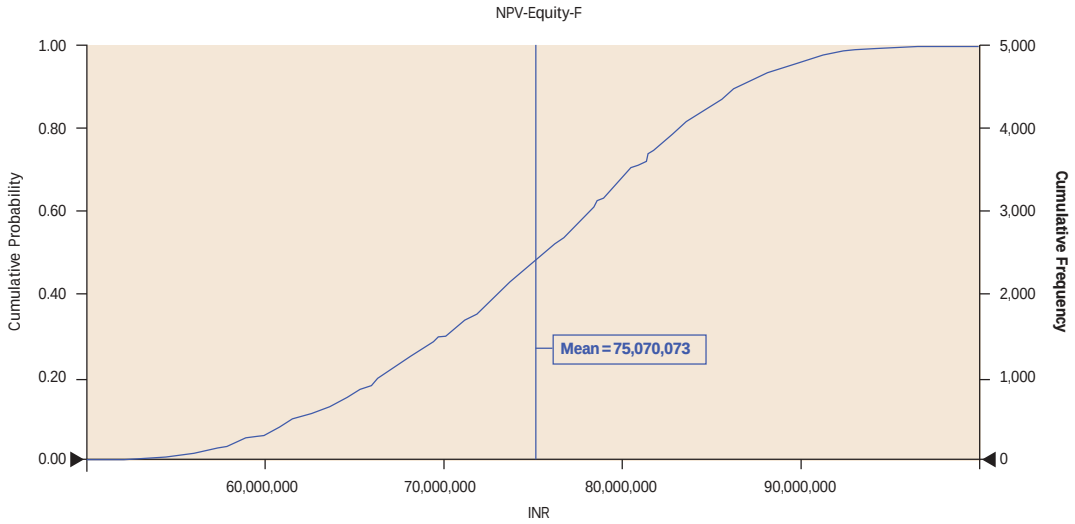
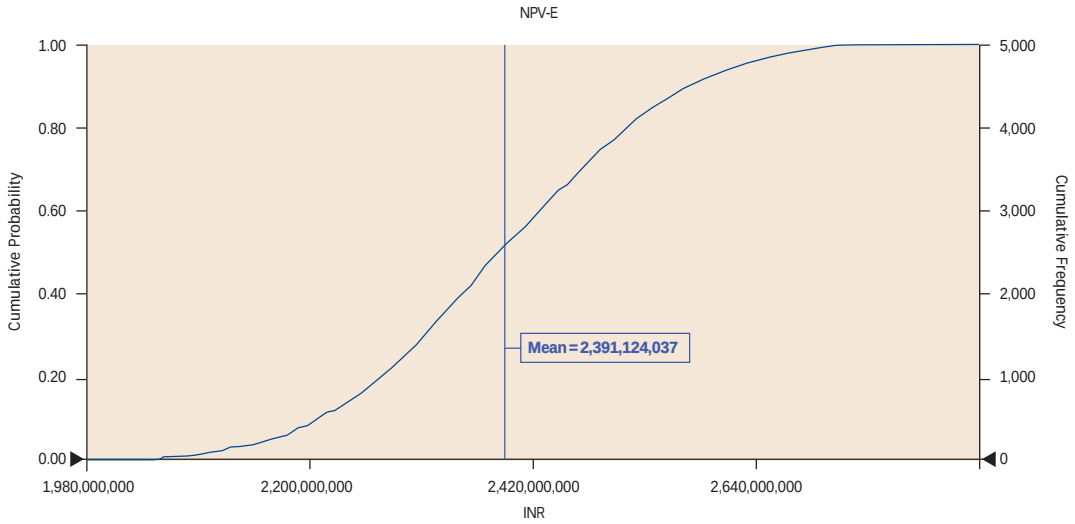
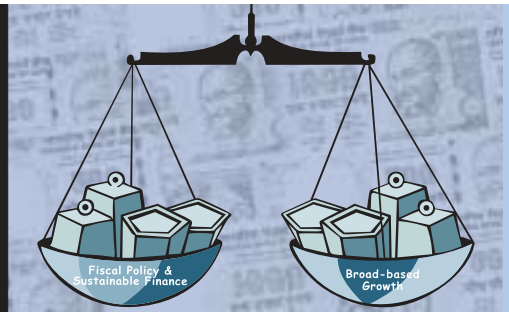


Figure 2



- The project can also be executed on a BOO basis with positive NPV, but somewhat lower NPV than for KPTCL. BOO is assumed to earn INR 0.075 per kW on all energy transmitted and needs at least INR 0.065 per kWh to breakeven.
- From an economic perspective, the project is very attractive. Nearly all the net gains accrue to the consumers of electricity. While the owners of the project gain a significant net benefit, this largely offset by revenue losses to the government. In particular, it is noted that the company tax incentive awarded for electricity sector investment results in no company taxes paid over the ten-year investment analysis horizon applied to this project.



Road and Transportation Sectors

Guidelines for Road Projects

Introduction

There is increasing recognition that the quality of a country's infrastructure is an important determinant and prerequisite for economic development. Roads, both urban and rural, are key components of the infrastructure system in a country. Similarly, government operated transport services allow the low income group population to have access to economic mode of transportation.

The project appraisal must ensure that the present value of the sum of all the economic benefits from the road exceed the present value of the costs. Typically, there will be no financial cash inflows, unless there are toll charges for the road. Thus, the financial NPV (Net Present Value) will be negative. For a toll road, the government has to regulate the toll structure of the operator of the toll road. This is to ensure that the investor receives a reasonable rate of return and at the same time make sure the users are not charged excessive tolls.

In many urban places, the existence of traffic congestion is clear evidence of the demand for new roads. In rural areas, the main criterion for new road projects is the need for additional connectivity which depends upon the villages and the population that do not have road access.

Main Economic Benefits

If a toll is charged for the road, it is also an indication of the consumers' willingness to pay for the services or the economic benefits derived by the users. However, most developing countries do not charge a toll and the economic benefits have to be estimated indirectly. Good road projects generate the following key economic benefits:

- Decrease the travel time for users and reduce congestion;
- Decrease the delivery time for goods and services;
- Reduce the annual vehicle operating costs (VOC); and
- Increase safety and comfort in travel and reduce accidents.

Travel Time for Users

With a good road, travelers and transporters take less time to complete their journeys. The time savings is valuable to the users of the road. To measure the economic benefits in monetary terms, we have to estimate the opportunity cost of the time for the different categories of users and the purposes of the trip. In other words, how much do the users value their time savings? There will be great diversity in the types of users: trucks, buses and private vehicles. Also, the value of the time savings will depend on the timing of the trips.

The value of the time saving is measured by the income of the population group for whom the time savings occurs.

Also, one has to distinguish between the value of working time and the value of nonworking (or leisure) time. As a rule of thumb, the value of nonworking time is approximately 30 percent of the weighted average of the value of the working time for the users of the road.

If there is a comparable road that is currently charging a toll, then the toll charge may be an

approximate assessment of the value of the time savings from using the road. If there is no comparable toll road, then we must rely on other survey information that measures the willingness to pay of the road users.

Delivery Time for Goods and Services

A good road reduces the delivery time for goods and services. It lowers the cost for the existing providers of goods and services. In addition, it may encourage the production of new goods and services. In the absence of information, we may add up the value of the vehicle cost, the time value for the driver and the occupants of the vehicle.

Annual Vehicle Operating Costs (VOC)

The quality of the road affects the annual vehicle operating costs (VOC). One has to estimate the reduction in the maintenance costs for different types of vehicles.

Reduction in Accidents

A good road will increase safety and lead to a reduction in accidents. However, it is also true that when roads are good some drivers indulge into speeding and that may increases the chances of accidents.

Risks of Road Projects

In a road project, one of the key risk variables is the traffic projection over the life of the project. One must ensure that the estimates are reliable and realistic.

Another key risk variable is the value of the time saved. The traffic projections should be disaggregated by the type of vehicles, time of day and the professions of the occupants in the vehicles. If there are toll charges, then it is important to accurately estimate the willingness to pay (WTP) of the travelers.

To ensure that the forecasted economic benefits of the road, in terms of time savings and reduction in VOC, are realized over the life of the project, the promoters of the road project should make the necessary financial arrangements for the investments during the investment period and the maintenance costs during the operations phase. Otherwise, the economic benefits will be reduced from the delays due to the nonavailability of funds during the investment period, and the deterioration in the conditions of the road during the operations phase due to the lack of maintenance.

Road Maintenance

If no tolls are charged for the road project, then the elements of the financial Net Cash Flow (NCF) profile will be negative, consisting of the cash outflows during the investment period and the expenditures on operations and maintenance. Often the rates of return on road maintenance projects are very high and may be higher than the returns on new roads.

Public Private Partnerships on Road Projects

In some cases, the demand for a road project may be sufficiently high to attract private sector participation. With private equity participation, the toll structure should provide a fair return to the equity investor, taking into account the risks of the road project. For example, in some cases, the road project may be sanctioned on a Build Operate Transfer (BOT) basis.

With project finance, the equity investor has recourse only to the cash flows that are generated from tolls with the road project.

Outcome of Analysis

The calculations show that the road rehabilitation project is financially nonviable while economically it is very attractive. Thus, the outcome of the analysis conforms to the normal pattern of results of such projects.

Conclusion

Roads are an integral part of the infrastructure system in a country, and contribute to economic development by creating benefits in terms of time savings for the users and reduction in vehicle operating costs.

Rehabilitation of Navalgund to Kushtagi Road Project

Introduction

It is well understood that roads lead to the prosperity. Roads lead to mobility and mobility is important requirement for economic growth in any country. Economic activities flourish in areas where accessibility is good and mobility is fast.

At present, different types of roads that exist in the State are National Highways (NHs), State Highways (SHs), Major District Roads (MDRs), Other District Roads (ODRs) and Rural roads (RRs). The total length of first three types of roads is around 52,000 kms.

There has been about 10 to 12 percent increase in traffic each year. On SHs, the annual growth of traffic has been about 12 to 15 percent. The traffic on village roads and other district roads has also registered an increase of 10 to 12 percent per annum. Not only does the existing roads need widening and strengthening to match the current and future traffic demands, but new roads also need to be constructed to improve accessibility, reduce distances and decongest existing roads.

Nearly 71 percent of SHs is single lane, 22 percent is intermediate lane and only 7 percent is two-lane in Karnataka. Among the MDR, 98 percent is single lane while 2 percent is wider than single lane. Almost all the SHs (99.9 percent) are surfaced while only 65 percent of MDRs are surfaced. Almost all the village and rural roads is single lane and unsurfaced.

A sustained program of road development, rehabilitation and maintenance needs to be quickly initiated not only to minimize the diseconomies and regional imbalances but also to ensure that the desired economic growth is not constrained by a poor road infrastructure.

The State's allocation is about INR 1, 000 million annually for repairs and maintenance of PWD roads. 80 percent is earmarked for resurfacing and about 1500–2000 kms can be surfaced out of nearly 40,000 kms.

Project Description

The current project involves rehabilitation (i.e., improving/widening the existing road to a minimum width of 5.5m) of the road from Navalgund to Kushtagi (97 kms long). Part of the road (25.6 kms) is MDR, while the remaining section (71.4 kms) is part of SH30 .The project road runs predominantly on black cotton soils mainly the section between Navalgund to Belavaniki (MDR) and Belavaniki to Gajendragarh (SH 30). The project road connects to National Highways NH 218 (Bijapur-Hubli) at Navalgund and NH 13 (Sholapur-Mangalore) at Kushtagi. The project road is entirely a single lane carriageway with some selected sections in village and urban limits having widened to intermediate lane width of 5.5m. The proposed widening of the road will establish a good connectivity to major commercial places in the state such as Hubli and Dharwad.

Brief details of the project are as follows:

Road Characteristics

Total length of the road is 97 kms. Its width will be made uniformly to 5.5 meters.

Total Investment and Financing Arrangement

Total investment cost is expected to be INR 4660 lakhs. 80 percent of the investment cost will be raised as loan. The component of bank loan is expected to be INR 3728 lakhs. The remaining amount of INR 932 lakhs will be provided by the government as its equity contribution.

INR 4060 lakhs that comes to 87 percent of the total investment cost will be the base cost. INR 500 lakhs or 11 percent of the investment cost will be for physical contingencies and INR 100 lakhs or 2 percent of the investment cost will be the cost of the supervision of the project.

The construction period is two years. 40 percent of the cost will be spent in the first year while the remaining 60 percent will be spent in the second year. In the first year, the base cost will be INR 1624 lakhs while in the second year it would be INR 2436 lakhs. Similar proportion will be spent for physical contingencies and supervision.

The Bank will charge an interest of 12 percent on this loan. The repayment period of the loan will be 8 years starting from the year of commission of the project (year2).

Axle Load Survey

The intensity of traffic loading and the corresponding damaging factor for commercial vehicles is an important parameter for the design of pavements. The government has not carried out axle load surveys through portable weighing system. So the recommendations of the Indian Road Congress -37 that provides the indicative VDF values as given.

Table 5: Indicative VDF Values

Commercial Vehicles	Indicative VDF Values	
	Plain	Rolling
0-149	1.5	0.5
150-1500	3.5	1.5
Above 1500	4.5	2.5

Operations and maintenance cost is calculated by dividing the vehicle damaging factor by 500.

Operations and Maintenance

Operations and maintenance costs include patching, annual and other maintenance, overlay, edge repair and crack sealing. The cost per square meter for patching in annual maintenance will be INR 300. The cost of other maintenance will be INR 167 per square meter. The overlay will cost INR 181 per square meter while crack sealing and edge repair will cost INR 8 and INR 53 per square meter, respectively.

Working Capital Requirements

The toll will be collected on the spot and hence the amount receivable will be zero. The amount payable will also be zero. The project will however require 8 percent of the O and M expenses as cash balances.

Traffic Survey Results

In the Planning, design, operation and management of a highway system, an appreciation of the traffic characteristics is one of the basic requirements. The base year (2003) traffic characteristics of the project road corridors starting from Navalgund (Km 0/0 of MDR) to Kushtagi (Km 64/1 of SH 30) were assessed through primary surveys supported with data collected from secondary sources. Based on the traffic survey data and secondary

data related to social and economic development of the influence area, the traffic growth rates for various modes of vehicles were derived for the design life period. Accordingly, the traffic forecast figures had been finalized.

The following traffic surveys were carried out:

- Traffic volume count surveys at four locations for three days;
- Origin and destination surveys for 24 hours at two locations;
- Axle load survey at one location for 24 hours; and
- Journey time, speed and delay studies over the entire project road.

The results of the survey were as follows:

Table 6: Average Daily Traffic Breakdown per Vehicle

Average Daily Traffic at Base Year (2003)	No.	Growth/ Year
Two Wheelers	479	8.80%
Car/Jeep/Van	250	8.30%
Three Wheelers	122	8.30%
Mini Bus	59	7.20%
Bus	123	7.20%
Light Goods Vehicle	49	7.60%
Two Axle	148	8.60%
Three Axle	34	7.90%
Multiaxle	17	11.60%
Agritractor	70	0.00%
Nonmotorized Vehicles	324	0.00%
Total Vehicles	1676	

The project road was divided into four homogeneous sections based on preliminary reconnaissance studies in such a way that the traffic intensity within a particular section would be more or less uniform. These sections are as follows:

1. HS1 (Section1)- (Kustigi to Gajendragarh).
2. HS2 (Section2)- (Gajendragarh to Ron).
3. HS3 (Section3) - (Ron to Belavaniki).
4. HS4 (Section4) - (Belvanki to Navalgund).

Weights and traffic at different locations were estimated as follows:

Table 7: Traffic Weights by Road Sections

	HS1	HS2	HS3	HS4
Average Daily Traffic at Base Year (2003)	25.9	27	18	26
Two Wheelers	493	807	424	161
Car/Jeep/Van	265	331	254	149
Three Wheelers	78	277	113	11
Mini Bus	29	76	94	46
Bus	160	134	134	68
Light Goods Vehicle	38	79	45	30
Two Axle	198	122	151	124
Three Axle	46	50	19	17
Multiaxle	33	18	10	4
Agritractor	88	104	33	42
Nonmotorized Vehicles	440	340	384	147
Total Vehicles	1868	2338	1661	799

For the sake of total vehicular loading on the road, the conversion factors for different multimodal transport system in equivalent passenger car units (PCU) were assumed as follows:

Table 8: Passenger Car Unit Breakdown by Transport Type

Type of Transport	PCU
Two Wheelers	0.5
Car/Jeep/Van	1.0
Three Wheelers	0.5
Mini Bus	1.5
Bus	3.0
Light Goods Vehicle	1.5
Two Axle	3.0
Three Axle	4.5
Multiaxle	4.5
Agritractor	8.0
Nonmotorized Vehicles	1.1

Toll Structure

The road is to be operated as a tolled road. The toll charged from each type of transport vehicle is indicated below. The toll charges will be adjusted for inflation every year for the sake of analysis.

Table 9: Toll Structure by Transport Type

X Toll Fees/Vehicle	INR	
Car/Jeep/Van	10.00	
Three Wheelers	1	Time of Car
Mini Bus	2	Times of Car
Bus	3	Times of Car
Light Goods Vehicle	2	Time of Car
Two Axle	3	Times of Car
Three Axle	4	Times of Car
Multiaxle	5	Times of Car
Agritractor	3	Times of Car

Economic Benefits

Economic benefits of road improvement and widening were also estimated. Savings after project as a result of fuel efficiency was estimated to be 65 percent of the fuel cost. For motorized vehicles, there would be further savings in labor cost as well as maintenance cost, each accounting for 50 percent in the saving in fuel cost. Additionally, there would be savings in the opportunity cost of labor for savings in motor travel time cost/vehicle/day which has been estimated to be 50 percent of total savings in fuel cost and operation and maintenance cost of the motorized vehicles.

For nonmotorized vehicles, labor charges before project was estimated to be INR 50 per vehicle/day and other maintenance charges before project was considered as INR 30 per vehicle/day. It is anticipated that 65 percent savings in labor charges as well as maintenance charges /day would be affected as a consequence of the project.

For the purposes of these estimation, price of fuel/litre can be taken as INR 48.

Discount Rate

Discount Rate on equity will be considered as 12 percent real.

Economic Life of the Project

Economic life of the project is 25 years.

Project Duration

Project operational life is 15 years.

Domestic Inflation Rate

Domestic inflation rate is taken as 7 percent for the project.

Financial Analysis

The financial analysis was conducted and financial viability of the project was calculated from the equity and total investment points of view. . The analysis of the project from the total investment perspective looks at the overall financial feasibility of the project. Unlike the equity point of view, it does not include the loan and loan repayments as cash inflows and outflows, respectively.

The pro forma cash flow statement from the total investment point of view is first developed in nominal terms in order to take into account the effects of inflation. The cash flows are then deflated to arrive at their real values. Cash flow profile from the equity point of view is obtained by adding the debt cash flow to the net cash flow from the total investment point of view.

The results of the financial analysis show that NPV real as well as nominal for both the equity and total investment points of view was INR 5679 lakhs. Apparently, the project can not be considered to be financially viable.

Sensitivity Analysis

The sensitivity analysis of the project was conducted for parameters such as toll fee, toll fee factor as well as two way analysis of traffic growth factor and toll fee and the results are indicated as follows:

Toll Fee

The project is very sensitive to changes in toll fee. If the toll fee is raised from INR 10 per vehicle to INR 30, NPV gets increased from -INR 5679 lakhs to -INR 3880 lakhs. The project will break even at a toll rate of INR 73 per car vehicle.

The pro forma cash flow statement from the total investment point of view is first developed in nominal terms in order to take into account the effects of inflation. The cash flows are then deflated to arrive at their real values. Cash flow profile from the equity point of view is obtained by adding the debt cash flow to the net cash flow from the total investment point of view.

Toll Fee Factor

Project is also very sensitive to toll fee factor. If the toll fee factor is increased, NPV gets better and the project breaks even at around 18.1 toll factor.

Vehicle Growth Rate and Toll Fee

If the simultaneous vehicular growth rate and toll fee is raised, NPV keeps on improving. At a toll fee of INR 32 per vehicle and growth factor of a little less than three, the project generates positive NPV.

Economic Analysis

For the construction of economic resource flow, the first thing we have to do is to calculate the conversion factors of various line items of financial cash flow.

Calculation of Conversion Factors

Following data is essential for the calculation of conversion factor (CF):

1. Foreign exchange premium;
2. Trade Tax/VAT;
3. Rate of excise duty;
4. Percentage of transportation and handling charges;
5. Foreign exchange component of transportation and handling charges;
6. Elasticity of supply for nontradable goods; and
7. Elasticity of demand for nontradable goods.

Data on various inputs both tradable and nontradables are indicated below to estimate the conversion factors of different items.

Table 10: Nontradable Items

Items	Subsidy	Tax	Elasticity of Supply (e^s)	Elasticity of Demand (h^d)
Bricks	0%	0%	0.6	-0.2
Sand(F.P)	0%	5%	3	-1
Gravel	0%	5%	2.0	-0.7
Labor	0	0	0.6	-1.2

Table 11: Tradable Items

Items	Price	Transport Charges	Port Handling Charge	Rate of Excise Duty	Sales Tax	FEP
Cement/MT	2897	4%	1%	18%	8%	10%
Steel/MT	20000	4%	1%	18%		
Bitumen and Oil/MT	11816	4%	1.25%	18%	8%	10%
Plant and Machinery/ Hour	1000	4%	1.25%	18%	8%	10%

For other miscellaneous items, financial price and economic price both are INR 2 per square meters

The share of different items in the construction and maintenance of road is indicated:

Table 12: Road Construction Input Percentage Shares

Item	Share
Cement	15%
Steel	12%
Sand	15%
Bricks	15%
Gravel	40%
Others	3%

Based on the above data and calculations, the conversion factors of different items are indicated:

Table 13: Road Construction Input Conversion Factors

Item	C.F
Cement	0.87
Steel	0.87
Sand	0.96
Bricks	0.96
Gravel	0.96
Others	1.00

The respective conversion factors are multiplied by the line items of financial cash flow for total investment point of view (TIP) in order to get the cash flow for economic from which economic NPV can be estimated.

The results of the economic analysis indicate that the economic NPV is +INR 2043 and IRR is 21 percent which appears higher than the hurdle rate. The project is therefore, considered viable from the economic point of view.

Distributive Analysis

In distributive analysis the gains and losses to various stakeholders are derived from present value of economic resources minus present value of financial resources. The resulting numbers show who benefits and who loses from the project. For doing it, we subtract each line item of financial cash flow (TIP) from respective line item of economic resource flow. The each line, thus obtained, is discounted by economic rate of discount to know that who gains or who looses from the project.

The results of the distributive analysis show that economic NPV is INR 7723 lakhs higher than financial NPV. The beneficiary from this project

will primarily be consumers to a tune of INR 6971 lakhs and to some extent suppliers who gain INR 783 lakhs. The government loses INR 31 lakhs. In view to a large externality generated for the consumers, the project is worthwhile to be implemented.

Table 14: Allocation of Externalities

(INR lakh)

Benefits	Consumer	Govt	Supplier	
Economic Benefits	6971			
Toll		0		
Salvage Value		-31		
Inflow				
Outflow				
Base Costs			419	
Physical Contingencies			52	
Supervision Costs			8	
Miscellaneous			0	
Patching			34	
Overlay			36	
Edge Repair			198	
Crack Ceiling			31	
Change in Cash Balance		5		
NPV of Externalities	6971	-31	783	7723

Risk Analysis

Risk analysis using the Monte Carlo simulation technique is applied to observe how the financial and economic NPVs of the project respond to possible variation in the values of the critical variables. The probability distributions are applied for various assumptions and 50,000 simulation runs were given. Crystal Ball reports are generated. Following assumptions have been taken for doing the risk analysis:

Risk Analysis has been done using the application software "Crystal Ball". The identified risk variables are:

(a) Cost Overrun Factor;

(b) Toll Fees; and

(c) Traffic Growth Factor.

The normal values and probability distribution of these parameters are indicated below:

Assumption: Traffic Growth Factor

Normal distribution with parameters:

Mean 1.00
Std. Dev. 0.10

Assumption: Toll Fee

Normal distribution with parameters:

Mean 10.00
Std. Dev. 1.00

Assumption: Cost Overrun

Normal distribution with parameters:

Mean 1.00
Std. Dev. 0.10

According to Monte Carlo simulation analysis, forecasts for financial NPV range from INR-7567 lakhs to INR-3623 lakhs with the base figure of -INR 5679 lakhs. The financial NPV can thus never be achieved for this project. Forecasts for economic NPV are however much brighter. These range from INR 4151 lakhs to INR 196 lakhs with the base figure of INR 2043 lakhs. The economic NPV is thus never negative. So, the project is quite feasible from economic point of view.

These are indicated in the charts.

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Figure 3: F. NPV (INR 5,679)

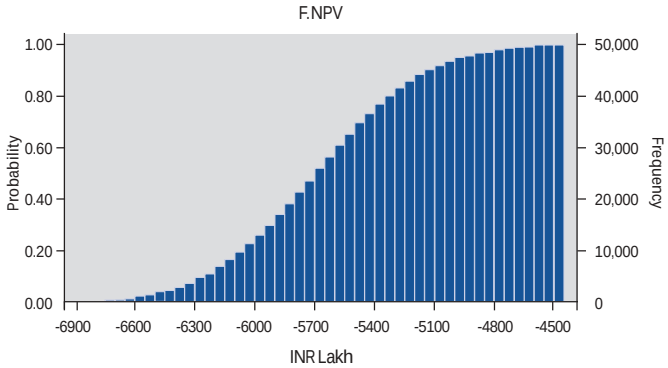


Figure 4: E. NPV (INR 2043 lakh)

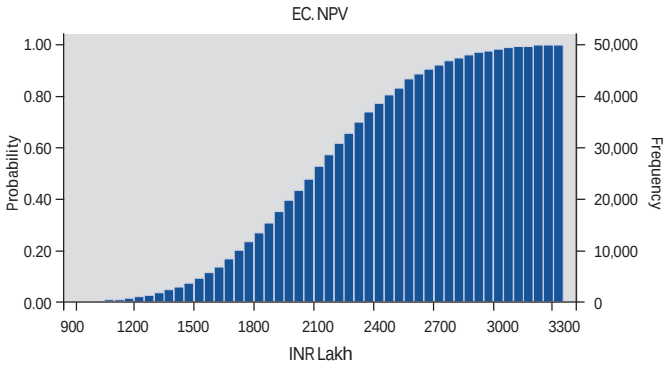
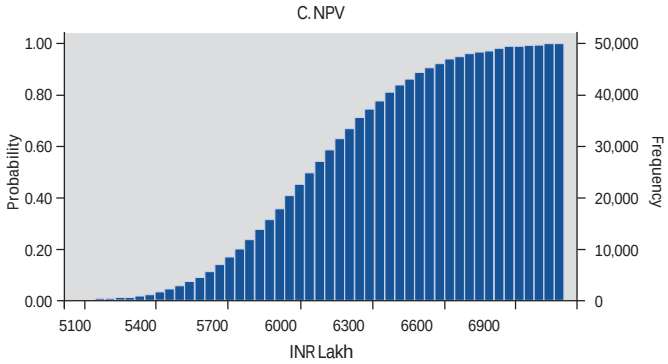


Figure 5: Consumer NPV (INR 6971 lakh)



Conclusions

The probability of financial NPV for being positive is 0 percent and the probability of economic NPV and consumer NPV to be –ve (negative) is also 0 percent. Therefore, there is no risk in the project from economic point of view and consumer point of view. Hence, project can be taken up.

Recommendations

As of now, currently, no toll is being collected on the project road in the state. For study purpose, it was assumed that the toll model as assumed in the project will be able to meet the annual maintenance expenditure on roads to some extent. Hence this type of toll model can be taken as a pilot project. If this yields fruitful results, this can be extended to other suitable roads in a phased manner.

Transport Sector Project Acquisition of a Bus Fleet

Introduction

With the creation of the Government of Uttaranchal Pradesh, a great need was felt for augmenting the transport infrastructure of the State. Immediately following this, the Uttaranchal Transport Corporation (UTC) came into existence with following objectives:

(a) To promote the development of road transport through the participation of the public, trade and industry;

(b) To extend and improve facilities of road transport; and

(c) To provide an efficient and economic system of road transport service;

The Uttaranchal Transport Corporation has three regional offices namely Dehradun, Nainital and Tanakpur with 18 depots, 18 workshops, three regional workshops and a fleet of around 957 buses. There is one Regional workshop for each three Regions i.e. for Dehradun Region in Dehradun, for Tanakpur Region in Tanakpur and for Nainital Region in Kathgodam. The Uttaranchal Transport Corporation has 41 bus stations out of which 22 bus stations are on ownership basis and 19 bus stations are on rental basis.

The project is for the purchase of 300 new buses. This exercise is intended to undertake the financial and economic appraisal of the project to find out the overall viability of this investment.

The Corporation is providing traveling facilities to more than one lakh Passengers daily through a network of 18 depots, 41 bus stations and with a fleet of 957 buses. Nearly 6500 employees are working in the Corporation. All the three Regional workshops are fully equipped with facilities for undertaking repair and maintenance of the buses. The daily revenue collection of the Corporation is nearly INR 40 lakhs resulting in a monthly revenue collection to the tune of around INR 12.00 crores.

Uttaranchal being a hilly State, UTC is proposed to play a vital role in the economic development of the State by providing traveling facilities to the public. It is also playing important role in providing facilities for under developed areas by introducing bus services to meet the travel demand of the people inhabiting in a rural and hilly areas of Uttaranchal. After creation of the new state, the volume of traffic is increasing at a very fast rate.

There has been consistent demand from the public for introduction of new services and every effort is being made by the corporation to meet the demand of public by introducing new services but due to shortage of funds, their demand could not be met in full. Further presently most of the buses being used are very old and their running cost is very high.

UTC is incurring losses for the last so many years due to several reasons. The unauthorized operation and competition from the illegal operators is one of the main reasons for the losses. The State Government was formerly giving financial aid to the transport corporations but after the liberalization of economy, Government stopped to support to the loss-making corporations. Therefore, it was unavoidable for UTC to depend on loans from financial institutions.

In view of the above, UTC has taken up overall infrastructure improvement of the transportation system by way of introducing of 300 new buses. Major Towns and capitals of neighboring states are proposed to be connected by these services. With the augmentation of these services, the traveling public will get benefited.

Project Description

The project is for the purchase of 300 new buses. When UTC was created, it had old and ruined fleet of 957 buses out of which more than 75 percent buses had completed their life of eight years which resulted into low load factor say about 50 percent of the bus capacity and low diesel average about 4.32 km/lt. Therefore, running of these old buses caused heavy losses which prompted the UA Government to propose the purchase of 300 new buses in the first phase. This exercise is intended to undertake the financial and economic appraisal of the project to find out the overall viability of this investment.

It further sanctioned a sum of INR 15.90 crores as share capital to purchase new buses. Initially, UTC decided to purchase 300 new buses for which INR 32.90 crores is required as the cost of one body built bus comes to about INR 11.00 lakhs. Remaining INR 17.00 crore is to be taken as loan from financial institutions for a period of five years. HUDCO is the institution, which provides financial aid for the infrastructure projects. Purchase of new buses comes under the infrastructure projects as categorized by HUDCO. For the support of UTC, the State Government is ready to provide the government guarantee against loan taken from HUDCO.

The main features and details of the project are as follows:

Main Purpose of the Project

To provide comfort and luxury to the passengers, to increase the load factor, to reduce the maintenance, spares and fuel cost resulting into profit, to ameliorate the working conditions of the employees and expedite their social security payments, to reduce pollution, to compete successfully with the other parallel transport services, etc.

Targeted Beneficiaries

Public as passengers and the employees of the corporation are the main targeted beneficiaries. By replacing the old buses with new ones, pollution would be reduced resulting into healthy environment for the public at large.

The Location of the Project

Connecting all district headquarters to the capital city Dehradun and connecting Uttaranchal to some more big cities like Jaipur, Chandigarh, Pushkar, Shimla, etc.

The Size of the Investment

The total investment towards purchase of 300 new buses is about INR 30 crores.

Type of Technology

The UTC would purchase 166, 205, 210 and 218 wheel base chassis from Tata and Leyland companies. The bus bodies will be ordinary, semideluxe and deluxe (Hi-tech).

Sources of Finance

Out of total investment of INR 32.9 crores, a loan of INR 17 crores to be taken from HUDCO on

Government guarantee @ 8.5 percent interest and the balance amount of INR 15.9 crores in the form of share capital from UA Government.

Other Economic Benefits and Issues

Safe journey and reducing accidents, pollution control, developing public confidence to travel by UTC buses, reducing journey time, to earn more profit, etc.

Project Duration

The project will be for five years.

Composition and Cost of the New Fleet

Out of 300 new buses, 100 buses will be of 166" wheel base, seating capacity 36 and cost per bus will be INR 10.5 lakhs. i.e. total cost of these 100 buses will be INR 10.50 crores.

40 buses of 185" wheel base, seating capacity is 42 seats per bus and cost per bus is INR 10.50 lakhs i.e. total cost of these 40 buses will be INR 4.20 crores.

20 buses of 205" wheel base, seating capacity is 52 seats per bus and cost per bus is INR 10.50 lakhs i.e. total cost of these 20 buses will be INR 2.10 crores.

100 buses of 218" wheel base, seating capacity is 58 seats per bus and cost per bus is INR 10.50 lakhs i.e. total cost of these 100 buses will be INR 10.50 crores.

40 deluxe buses of 218" wheel base, seating capacity is 45 seats per bus and cost per bus is INR 14.00 lakhs i.e. total cost of these 40 buses will be INR 5.60 crores.

Thus, total cost of the 300 new buses of different wheelbases will thus come to INR 32.90 crores.

The total investment cost wheel base wise is shown in the table:-

Investment Costs	INR In Lakhs
166 Wheel Base	1050
185 Wheel Base	420
205 Wheel Base	210
218 Wheel Base	1050
Deluxe	560
Total	3290

Means of Financing

Out of INR 32.90 crores, equity from State Government will be INR 15.90 crores for which real opportunity cost is presumed as 12 percent and a loan of INR 17.00 crores from HUDCO at a concessional rate of 3.10 percent real rate of interest (8.25 percent nominal rate of interest). The repayment will be made in five annual installments.

Inflation Rate

The inflation rate is assumed to be 5 percent per year.

Occupancy Rate

It is presumed that occupancy rate in first and second year will be 65 percent, will decrease to 60 percent in third and fourth year and in fifth year it will be 58 percent.

Fare Structure

Fare per passenger per km for wheel base 205" and 218" is 46 paisa, for 166" and 185" wheel base is 74 paisa per passenger per km in hilly area and for deluxe fare is 78 paisa per passenger per km. It is presumed that fare will be same for first three years and will be increased by 10 percent in fourth and fifth year.

Daily Mileage Coverage

166" and 185" wheel base buses will run 300 kilometers per day in first and second year, 280

kilometers per day in the third and fourth year and 262 kilometers per day in the fifth year.

205", 218" wheel base and deluxe buses will run 500 kilometers per day in first and second year, 450 kilometers per day in the third and fourth year and 400 kilometers per day in the fifth year.

It is presumed that running of all the buses in a month will be 28 days and running of bus during the year will be 12 months (28x12 days).

Operating Cost

Operating cost of running the buses is shown in Table 15.

Fuel cost is arrived by using INR 26.00 per liter cost of fuel and fuel average at five kilometers per liter. Tyre cost is arrived at on the basis of past experiences of different corporations. Average cost of one new tyre is approx. INR 6,500.00 and cost of one retreaded tyre is about INR 2000.00. In one bus four retreaded tyres on the rear wheel are used and two new tyres are used on the front wheels. Average kilometers run by one retreaded tyre comes to between 15000 and 25000 depending upon the road conditions and load on the bus and the average kilometers run by new tyre comes to between 45000 and 65000 on the same conditions described above. The cost of spare parts is also taken on the basis of past experiences of different corporations. The cost of spare parts on new vehicles comes between 18-25 paise/km. So the average cost of 20 paise/km is taken in this project. Salary is taken as INR 5.25/km based on the actual expenses of past years. In this corporation, seven employees per bus are working. Other expenses are not fixed, but on the basis of past experience its cost is taken as INR 1.00/km. In other expenses mainly motor accident claims, electricity, telephone, stationary tickets printing advertisement and miscellaneous are included.

In distributive analysis the gains and losses to various stakeholders are derived from present value of economic resources minus present value of financial resources. The resulting numbers show who benefits and who loses from the project. Because the conversion factor for revenue is less than 1 due to sales tax, transport, excise duty, etc., the negative number shows that the government is gaining the difference due to taxes. It is effectively a loss to the paying consumers.

It is presumed that running cost will increase at the rate of 3 percent per year.

Revenue Stream

Revenue is based on kilometers and the load factor. Load factor is based on income per

Table 15: Operating Cost per kilometer in Rupees

205 and 218 Wheel Base		166 and 185 Wheel Base	Deluxe	Weights
Fuel	5.20	5.20	5.20	43.15%
Spares	0.20	0.20	0.20	1.66%
Tyres	0.40	0.40	0.40	3.32%
Salary	5.25	5.25	5.25	43.57%
Others	1.00	1.00	1.00	8.30%
Total	12.05	12.05	12.05	100.00%

kilometer. Kilometers run, multiplied by income per kilometer is the total revenue. Besides the revenue from the fleet operation, it is presumed that additional revenue of
INR 100 lakhs per year will be generated from other sources such as income from canteens, parking fee, income from sale of scrap, etc.

Working Capital

It is assumed that 4 percent of total income will be accounts receivable, 8.33 percent of operating cost will be accounts payable and 5 percent of total revenue will be as cash balance.

Accounts receivables are there on account of the services provided to the Government departments, buses provided for election and law and order situation, road warrant issued to defense departments, railway out agency services, postal mail services. Bills are raised for the above services and some amount is outstanding in the end of the year as accounts receivables. Similarly the accounts payable include the outstanding dues of big suppliers like Indian Oil Corporation, TATA and Leyland, liability of outstanding taxes of Government Employees liability, security deposits of employees and outside parties.

Liquidation

Depreciation will be calculated by straight line method and annual depreciation rate is presumed to be 18 percent.

Financial Analysis

Based on the above parameters, financial cash flow statements were prepared. For preparing this statement, the following tables were first created:

(a) Inflation Index;

(b) Loan Repayment Schedule;

(c) Revenue Table;

(d) Working Capital Details; and

(e) Salvage Value.

The cash flow statements from the equity (government) and total investment point of view were generated both in nominal as well as real terms. The results from this analysis are as follows:

- Cash Flow (Nominal) from Government point of view: The NPV works out to INR 1960.32 lakhs and IRR is 86 percent;
- Cash Flow (Real) from Government point of view: The NPV works out to INR 1960.32 lakhs and IRR is 77 percent;
- Cash Flow (Nominal) from Total Investment Perspective: The NPV works out to INR 1960.32 lakhs and IRR is 43 percent; and
- Cash Flow (real) from Government point of view: The NPV works out to INR 1960.32 lakhs and IRR is 36 percent.

It can be seen from these results that NPV (Nominal), NPV (Real) from Government point of view and NPV (Nominal), NPV (Real) from Total Investment Perspective point of view comes the same i.e. INR 1960.32 lakhs which shows that project is good enough to be undertaken. Another factor, IRR is 86 percent and 77 percent from Government point of view as can be seen in cash flow, (Nominal) and (Real) respectively. IRR is 43 percent and 33 percent from total investment perspective as can be seen in cash flow, (Nominal) and (Real) respectively. IRR is thus higher than the respective rates of discount in each case and is a positive feature for the project feasibility.

Sensitivity Analysis

Sensitivity analysis was conducted in respect of the following parameters:

(a) Total Operating Cost;

(b) Fuel;

(c) Cost Overrun;

(d) Salary;

(e) Inflation; and

(f) Change in Passenger Fare.

Main results of the detailed analysis are given below:

- The project is viable up to the increase of INR 1.36 per kilometers in total operating cost i.e. if the total operating cost which is INR 12.05 per kilometer increases up to INR 13.41, it will run in no profit — no loss basis;
- The fuel cost which is assumed at INR 5.20 per kilometer can be increased up to INR 6.56 per kilometer for the viability of the project. Since Oct-2005, Government of Uttaranchal has introduced VAT; therefore, subsidy portion of 17 percent on fuel is now not available. Still then without subsidy, sensitivity at the fuel price which comes to INR 6.27 per kilometer on assuming average of 5.10 kilometers per liter @ INR 32 per liter the project is viable. Now the Government has decided to give the subsidy amount in the form of grant .The additional expenses on fuel due to introduction of VAT is approx. INR 80 lakhs per month;
- The salary cost, which is assumed at INR 5.25 per kilometer, can be increased up to INR 6.61 per kilometer for the viability of the project. Beyond this, the project will be at risk;
- If operating cost remains the same and the fare structure is reduced upto 8.99 percent the project will be viable and with further decrease in base fare, project becomes unviable; and
- If the capital cost overrun below 62.76 percent, the project will be viable i.e. if project investment of INR 3290 lakhs increases up to INR 5354.93 lakhs, the project can sustain this increase.

Economic Analysis

For the construction of economic resource flow, the first thing we have to do is to calculate the conversion factors of various line items of financial cash flow. Economic resource flow is prepared by multiplying conversion factor to each line of financial cash flow.

Following data is essential for the calculation of conversion factor (CF):

1. Foreign Exchange Premium;
2. Trade Tax/VAT;
3. Rate of Excise Duty;
4. Percentage of Transportation and Handling Charges.
5. Foreign Exchange Component of Transportation and Handling Charges;
6. Elasticity of Supply for Nontradable Goods; and
7. Elasticity of Demand for Nontradable Goods.

Calculation of Conversion Factor

The parameters for calculating the conversion factors are identified as follows:

Nontradables:

There are two nontradable items, namely revenue and labor.

	Price	Tax	Nd	Es
Revenue	1	21%	-0.8	0.8
Labor	1	5%	-1.2	1.2

Tradable:

Tradable items are fuel, spare, tyres and equipment. It is presumed that foreign exchange content in the transport and handling will be 30 percent of the price. CIF price has 100 percent foreign content.

Table 16: Tradeable Items Economic Analysis

Item	Price	FEP	Subsidy	Sales Tax	Transport	Handling	Excise Duty
Fuel	1	12.50%	18%	21%	6%	0	16.20%
Spares	1	12.50%	0%	4%	4%	1.25%	16.20%
Tyres	1	12.50%	0%	4%	4%	1.25%	16.20%
Equipment	1	12.50%	0%	6%	3%	0%	16.20%

Based on the above information, the conversion factors have been calculated as follows:

Item	C.F.
Fuel	0.98
Spares	0.93
Tyres	0.93
Equipment	0.92
Revenue	0.91
Labor	0.98
Others	1

For economic resource flow, the cash inflow and the cash outflow tables were prepared. The economic NPV (real) comes to INR 321.23 lakhs and IRR 18 percent.

This shows that the project is economically viable also.

Distributive Analysis

In distributive analysis the gains and losses to various stakeholders are derived from present value of economic resources minus present value of financial resources. The resulting numbers show who benefits and who loses from the project.

Because the conversion factor for revenue is less than 1 due to sales tax, transport, excise duty, etc., the negative number shows that the government is gaining the difference due to taxes. It is effectively a loss to the paying consumers.

For accounts receivable, the figure of INR 11.64 lakhs shows that the corporation is losing that amount. For salvage value, the figure of (-) INR 13.56 lakhs shows that the corporation is gaining that amount because of the taxes which were paid earlier at the time of purchasing. For accounts payable, the figure of INR 4.89 lakhs shows that it is gain to others.

The result of distributive analysis shows that net value of externalities is INR 1291.58 lakhs.

Risk Analysis

Risk analysis of this project was done using Monte Carlo simulation technique to observe, how the financial and economic NPV of the

Table 17: Distribution of Externalities

Item Lines	Government	Project	Others
Total Revenue	-1944.60		
Change in Accounts Receivable		-11.64	
Salvage Value		+ 13.56	
Investment Cost		-267.60	
Total Operating Cost		-392.23	
Change in Accounts Payable			+4.89
Change in Cash Balance			
Total	**-1944.60**	**-657.91**	**+4.89**
NPV (Fin at financial Rate of Discount)	1,960.32		
NPV (Fin at 12 percent Rate of Discount)	1,612.81		
NPV (Eco at 12 percent Rate of Discount)	321.23		
Difference	-1291.58		

project respond to possible variations in the value of the following critical variables and their respective probability distribution.

Assumption: Cost Overrun (%)

Triangular distribution with parameters:

Minimum 0%
Likeliest 0%
Maximum 12%

Assumption: Fare Growth Factor

Triangular distribution with parameters:

Minimum 0%
Likeliest 0%
Maximum 10%

Assumption: Fuel

Triangular distribution with parameters:

Minimum 5.00
Likeliest 5.20
Maximum 6.00

Assumption: Inflation Rate %

Custom distribution with parameters:

Minimum	Maximum	Probability
2%	4%	0.15
4%	6%	0.75
6%	8%	0.05
8%	10%	0.05

Assumption: Occupancy Rate 1-2

Triangular distribution with parameters:

Minimum 60%
Likeliest 65%
Maximum 75%

Assumption: Occupancy Rate 3-4

Triangular distribution with parameters:

Minimum 55%
Likeliest 60%
Maximum 70%

Assumption: Occupancy Rate 5

Triangular distribution with parameters:

Minimum 50%
Likeliest 58%
Maximum 60%

Assumption: Other Income

Triangular distribution with parameters:

Minimum	5,000,000.00
Likeliest	10,000,000.00
Maximum	15,000,000.00

Assumption: Running Cost Growth Rate

Triangular distribution with parameters:

Minimum	1%
Likeliest	3%
Maximum	10%

Assumption: Spares

Triangular distribution with parameters:

Minimum	0.20
Likeliest	0.20
Maximum	0.50

Risk Analysis report after getting 50000 run Monte Carlo simulations shows the following results:

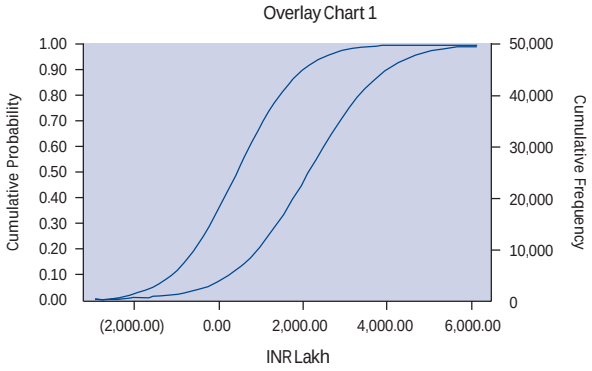
Forecast of NPV Economic

The economic NPV varies from - INR 4908.50 lakhs to + INR 5374.68 lakhs with a base value of INR 321 lakhs. According to the analysis, the probability of negative return is 34.64 percent. This shows that the project is slightly risky in economic terms.

Forecast of NPV Finance

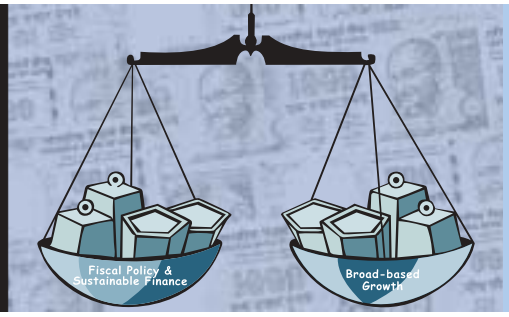
The financial NPV varies from - INR 4174.32 lakhs to + INR 7999.73 lakhs with a base value of INR 1960.32 lakhs. According to the analysis, the probability of negative return is 6.5 percent. This shows that the project is not very risky in financial terms.

The overlay chart indicates that the chart of NPV financial is towards right side of the chart of NPV economic. This shows that the project is more risky in economic terms and less risky in financial terms.



Recommendations

The above financial and economic analyses indicate that the project is economically as well as financially viable. While the project is not risky financially, it is slightly risky economically. It is therefore recommended that the project should be implemented.



Irrigation Sector

Guidelines for the Irrigation Projects

Introduction

In developing countries, irrigation projects in the public sector play a key role in improving agricultural productivity, raising farmers' incomes and promoting economic development. Often the irrigation projects target disadvantaged households in regions that do not have reliable water sources. The availability of water from irrigation projects enable farmers to increase the value of the crops that they grow.

Irrigation projects, if successfully completed on schedule, have the potential to generate substantial benefits for the farmers that receive the water. At the same time, the capital costs are huge, and the investment period is long. Furthermore, the design and implementation of the irrigation project may be complicated if there are multiple stakeholders and financiers. Typically, irrigation projects are financed with public funds because the benefits accrue mostly to small farmers and households, and the cost recovery, if any, would be insufficient to attract private sector participation.

Recently, the governments have become conscious of the budgetary constraints that they face and there has been a move towards preparing irrigation projects that are bankable. This means, the irrigation department which has been traditionally the department dealing with these projects has to approach banks for debt financing in addition to whatever funds they can procure from the government budget as public sector equity.

If the irrigation project is not properly formulated and implemented, there is a high risk that the economic benefits will not be realized over the life of the project, and consequently, there would be a big waste of public resources. Many irrigation projects are started and then stopped due to a lack of funds. Later, we briefly discuss the rehabilitation of an irrigation project.

A detailed risk analysis is essential for the success of an irrigation project. An understanding of the risk profile of the project allows the promoters of the project to design and implement risk management measures that increase the likelihood that the project risks will be mitigated, especially in the construction phase, and the benefits will be realized over the life of the project. Too often, irrigation projects fail because the risks during the construction period were not properly analyzed and the estimation of the benefits was overly optimistic. Below some of the risk issues that are associated with irrigation projects are also discussed.

Like all other projects, the irrigation project should be examined from the financial, economic and distributive points of view. Also, the cash flow has to be constructed from the point of view of the beneficiaries of the irrigation project, namely the farmers that receive the water.

Financial Point of View for the Irrigation Project

The financial Net Cash Flow (NCF) profile for an irrigation project will be mostly negative. During the long construction period, there will be cash outflows for investment costs. When the project begins to provide water to farmers, there may be small revenues if water charges are collected at all. The market price is not charged from the farmers. Typically, these water charges cover only a part of the operating and

maintenance costs. Most certainly, the financial Net Present Value (NPV) of the irrigation project (the financial NCF discounted at the financial discount rate) is negative. However, the main criterion for project selection is the economic NPV rather than the financial NPV.

Point of View of the Typical Farmer

To estimate the benefits of the irrigation project, the financial Net Cash Flow (NCF) for the typical beneficiary, namely the farmer that receives the water, is constructed. To get an estimate of the revenues, increased yield from irrigated farming should be taken into account and market prices of the various crops should b used. In fact, the benefit of irrigation is the incremental yield due to irrigation facility made available by the project.

To obtain the total benefits at the project level, this cash flow profile is multiplied by the total number of beneficiaries of the irrigation project.

The cash inflow for the typical farmer will be the revenues that he receives for selling the additional crops in the market. The cash outflows will be the cost of investments, inputs and the water charges, if any, that he has to pay. Generally, the Net Present Value (NPV) of this financial cash flow is positive and measures the benefits that the typical farmer receives.

If the irrigation project is not properly formulated and implemented, there is a high risk that the economic benefits will not be realized over the life of the project, and consequently, there would be a big waste of public resources. Many irrigation projects are started and then stopped due to a lack of funds.

Sensitivity analysis with this NPV may provide an estimate of the feasibility of cost recovery from the beneficiaries. Even a partial cost recovery scheme may favorably mitigate the adverse effects of shortfalls from the financing of operation and maintenance costs. See the discussion below in the section on risk analysis.

Economic Analysis of the Irrigation Project

The economic analysis is conducted by applying conversion factors to each of the line items in the total investment point of view. The conversion factors take into account the distortions in the economy, such as taxes, subsidies and externalities, which create the discrepancies between the economic and financial values. Generally, we would expect that the economic NPV of the irrigation project (the economic NCF, discounted at the economic discount rate or economic opportunity cost of capital) is positive.

The economic point of view may include positive externalities that result from the increase in the availability of irrigated areas. Furthermore, there may be additional externalities if disadvantaged households are the actual recipients of the water from the irrigation project.

Economic NPV of the irrigation project = Economic NCF, discounted by the economic opportunity cost of capital

In some instances, the economic NPV may be negative. Or there may be a high likelihood that the economic NPV is negative. It is important to understand the reasons for the negative NPV.

Distributive Analysis

In many irrigation projects, the intended beneficiaries are disadvantaged households. If this is indeed the case, then the project should have mechanisms or procedures for determining whether the intended beneficiaries are actually receiving the water that is provided by the project. In addition, the project may cater to basic needs in the irrigated region (nutrition) and a basic needs premium of 10 percent-15 percent should be added on top of the economic benefits from the project.

Risks of the Irrigation Project

In an irrigation project, there are many risks, especially during the construction period. The first risk is the availability of financing during the full investment period. In many cases, the irrigation projects are initiated even though the financing has not been secured for the whole investment period. Thus, there is the likelihood that the subsequent financing may not be available at the appropriate time. The estimation of the benefits assumes that the investment phase of the irrigation project will be successfully completed.

From a public investment point of view, it may be worthwhile to secure the financing for the whole investment period from all of the relevant stakeholders rather than take the risk of starting a project that may be stalled due to financing difficulties. It is recognized that there may be tremendous political pressures to initiate the irrigation project with partial financing, with the expectation that the subsequent financing will somehow be found. At the outset, this risk should be highlighted and the expected economic benefits should be adjusted accordingly. The premature construction of the project is not in the longer term interests of the ultimate beneficiaries of the irrigation project.

If there are expected delays due to the financing, then the estimation of the benefits should take the impact of the delays into account. Moreover, the estimation of the expected benefits should be linked directly to the likelihood of delays for financial and nonfinancial reasons. If there are expected delays in the completion of the project, then the expected benefits should be adjusted accordingly.

In addition to the delays from financing, there may be other factors that delay the successful completion of the investment phase. For example, there may be delays due to technical reasons or delay in procurement Again, all of these factors should be analyzed as part of the risk analysis to ensure that the estimated benefits are not overly optimistic.

After the successful completion of the investment phase, there may be risks during the operation and maintenance phase. For example, there may be shortfalls in the financing of the operation and maintenance costs. In some cases, it is assumed that the beneficiaries, namely the farmers, will pay, either partially or fully, for the costs of operation and maintenance. The risk analysis should assess the likely impact on the project if the financing for the operation and maintenance costs is not realized.

Financing the Recurrent Costs of an Irrigation Project

The recurrent costs for the irrigation project should be recognized in the annual budgets of the relevant departments of the local government. It is very likely that the costs for operation and maintenance will increase in real terms. This means that the water charges should

be linked to both the real increases (if any) and the expected inflation rate over the life of the project. If there is a big likelihood that there may be shortfalls in the funds for operation and maintenance, then contingency plans should be in place.

Avoiding Optimistic Projections of the Benefits

In addition, the **sensitivity** and scenario analyses should examine the impact of different values of the expected crop yields, prices of crops and area coverage on the economic NPV of the project. Often the estimated benefits are overly optimistic and during the course of the project, the forecasted benefits are not realized. As a benchmark, the irrigation project should use the actual benefits that have been realized from **comparable** irrigation projects.

If the outcomes of the irrigation project are very sensitive to certain variables, such as the expected crop yields and prices, then additional efforts should be made to obtain more historical data on these variables.

Rehabilitation of an Irrigation Project

If the "new" irrigation project is the rehabilitation of an irrigation project that was started many years ago and then stopped, then the analyst must ensure that the previous costs are not simply disregarded as "sunk" costs. It is important that the investments that have been spent in the "old" project are taken into account in the "new" project (opportunity costs).

Conclusion

Irrigation projects are essential for economic development and in many cases the projects are the only effective mechanisms for improving the welfare of disadvantaged households in farming communities that lack water resources for agriculture. However, to ensure the success of irrigation projects, it is important that the sensitivity and risk analyses identify the various factors that may impede the realization of the estimated benefits over the life of the project and enables the analyst to implement appropriate risk management protocols to mitigate the impact of the risk factors.

Maskinala Irrigation Project

Project Appraisal

Target Audience

- Field-level officers who prepare Estimates in the Water Resources department;
- Officers of Water Resources department involved in giving Technical Approval for the project;
- Officers from Planning department for giving opinion on the project;
- Officers from Finance department for giving financial clearance for the project; and
- Funding agencies or financial institutions (domestic and international), if any.

Why Conduct Project Appraisal

- The appraisal of the project helps in decision making (to accept or reject the project);
- To know the feasibility of the project both financially and economically;
- To know the risk factors involved in the project; and
- Proper regulation of water tariff.

Maskinala Irrigation Project

Introduction

The geographical area of Karnataka is 1, 91,791 sq. km. accounting for 5.81 percent of the total area of the country. The culturable command area of the state is 1,40,598 sq. km. The net sown area is 1,07,000 sq. km. and the irrigable area is estimated as about 55, 000 sq. km.

Agriculture being the main occupation of the State, Irrigation plays significant role for obtaining increased yields from the land. Karnataka State has given top priority to Irrigation with the main objective of providing drinking water, creating irrigation potential and harnessing the Hydropower potential in the State. Further the Irrigation projects take care of the water scarcity and famine stricken areas. With a view to having optimum utilization of the available water, the projects are selected keeping in mind the multipurpose uses.

Prioritization for incurring expenditure in irrigation projects is as follows:

1. Completion of Ongoing and Committed Projects;
2. Promoting participatory Irrigation Management;
3. Operation and Maintenance; and
4. Repairs and Modernization.

Most of the irrigation projects are not financially viable. As compared to other States, water rates are less in Karnataka. Therefore water rates for various uses are to be revised in a phased manner and fixed so as to cover at least the O&M charges of providing services. Though there has been substantial increase in agricultural production, the revenue from water rates is to be increased proportionately.

Lingasur Taluk, Raichur District is a scarcity and famine stricken area where no Irrigation facilities exist at present. The population in this area is entirely dependent on agriculture. Due to untimely and scarce rainfall, it is difficult to grow even the dry crops. There is no way to improve the standards of living in this region except by providing irrigation facilities. Therefore, the state government has proposed to undertake Maskinala Irrigation Project to serve the region. It is a medium irrigation project near Maraladinni village in the Taluk. The project envisages construction of Central Concrete spillway of 57 mts length and earthen dam on either side across Maskinala, a tributary to Tunga Bhadra River, to provide irrigation facilities to 3000 Ha, of dry lands in Raichur District.

The total catchment area of the project is 800 sq. km having a planned irrigation potential area of 3000 Ha. The project was conceived in 1976. The latest estimated cost of the project is INR 4835 lakhs. The major investment on the project started from the year 1994. The Total Expenditure of the project so far is INR 4835.00 lakhs.

The financial and economic analysis is been carried out for Maskinala Irrigation project to ascertain whether the project is financially and economically viable.

Project Description

The details of the Project including assumptions for the financial analysis are as follows:

Design Specification of the Reservoir

After construction, gross storage of the reservoir will be 0.5 TMC. The live storage will however be only 0.4 TMC. Average river bed level will be 453.00 m, dead storage level will be 463.30 m and the full reservoir level will be 472.12 m.

Design Specification of the Dam

The dam will be an earthen dam with zonal section. Length of the dam will be 813.80 m. Top width of the dam will be 3.66 m. The maximum height of the dam will be 23.74 m. Free board of the dam will be 2.76 m.

Design Specification of the Spillway

The spillway will be of the Gated Ogee spillway Type. The length of the spillway will be 57.00 m. The crest level will be RL 463.62 m. The gates will be radial type with dimensions of 12 m X 8.5 m. The maximum flood discharge of the spillway should be 2590 Cumecs.

The l.b.c and r.b.c. outlets will be designed as box type and their capacity at the head will be 1.485 cumecs and 0.775 cumecs, respectively.

Design Specification of the Canal

The length of the canal at l.b.c will be10.00 km and at r.b.c will be 11.50 km. The irrigable area will be 1940 ha and 1061 ha respectively. The corresponding discharge level will be 0.51 TMC and 0.27 TMC respectively. The side slope will be in the ratio of 1.5:1 in both the cases. The bed width will be 2.00 km and 1.60 km respectively. The F.S.D will be 0.70 m and 0.60 m at the two levels.

Investment Cost of the Project

The project was initiated in 1995 and completed in 10 years in 2004. The total investment cost of the project is as follows:

Table 18: Investment Costs

(INR in lakhs)

Construction	4430.00
Land	220.00
Building	83.00
Tools and Plants	102.00
Total Investment	**4835.00**

Means of Financing

The means of financing of the project is as follows:

Project Financing	INR in lakhs
State Government	1833.73
NABARD	2679.27
AIBP	322.00
Total	**4835.00**

The year-wise break up of the cost is as follows:

Table 19: Project-cost Breakdown Annual Figures – 1995-2005

Year	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Total	850.35	445.78	521.09	717.51	742.1	546.14	388.98	267.77	200	155.28
4430.00	653.07	370.00	479.40	674.46	727.26	535.63	379.57	262.41	196.00	152.17
220.00	120.75	40.12	20.84	21.53	7.42	5.46	3.89	0.00	0.00	0.00
83.00	42.52	22.29	10.42	7.18	0.00	0.60	0.00	0.00	0.00	0.00
102.00	34.01	13.37	10.42	14.35	7.42	4.45	5.52	5.36	4.00	3.11
4835.00										

The loan disbursement schedule is as follows:

Table 20: Loan Disbursement Schedule

	Total	1995	1996	1997	1998	1999	2000	2001	2002
NABARD	2679.27	27.23	325	415.71	607.35	719.37	385.01	154.95	44.65
AIBP	322	322							

NABARD loan will carry an interest rate of 7.5 percent while AIBP loan will carry an interest rate of 7 percent. The repayment period for NABARD loan will be 5 year starting in the year 2005 and AIBP loan will be repaid in 15 years from 2008.

Capacity Utilization

The planned irrigation potential for Kharif (June-Sept.) is 2275 ha and for Rabi (Oct-March) is 726 ha. The capacity utilization will be increased from the year 2003 for the wet crop and proportionally decreased for dry crops year after year until 2007 when the entire crop will be irrigated by the system.

Table 21: Crop Capacity Utilization from 2003-07

Capacity Utilization	2003	2004	2005	2006	2007
Capacity Utilization Wet	57%	64%	80%	95%	100%
Capacity Utilization Dry	43%	36%	20%	5%	0%

Pre- and post-project Implementation

The pre-project crop use, yield and market price per quintal is indicated:

Table 22: Preproject Implementation for Different Crops

Crop	Area in Ha	Yield/ha in Quintal	Rate / Quintal
Kharif			
Jowar	850	65	900
Bajra	486	30	800
Tur	162	15	2900
Groundnut	776	25	2600
Total	2274		
Rabi			
Jowar	242	45	1050
Wheat	242	30	950
Cotton	242	25	3500
Total	726		
Fodder Receipt		30%	
Dung Receipt		10%	

The expenditure incurred in the crop production is indicated below:

Table 23: Crop Introduction Expenditure Breakdown

Type of Crop	Seeds in INR/ha	Fertilizers & Pesticides in INR/ha	Human Labor
During Kharif			
Jowar	100	1465	880
Bajra	110	710	440
Tur	330	755	440
Groundnut	1750	1720	440
	2290	4650	2200
During Rabi			
Jowar	70	1050	70
Wheat	660	1030	330
Cotton	165	780	70

The post-project implementation, cropped area for different crops and other relevant details are as follows:

Table 24: Post-project Implementation for Different Crops

Crop	Area in Ha	Yield/ha in Quintal	Rate / Quintal
Kharif			
Jowar	850	65	900
Bajra	486	30	800
Tur	162	15	2900
Groundnut	776	25	2600
	2274		
Rabi			
Jowar	242	45	1050
Wheat	242	30	950
Cotton	242	25	3500
Total	726		
Fodder Receipt		30%	
Dung Receipt		10%	

The expenditure incurred for crop production is indicated:

Table 25: Crop Production Expenditure Breakdown

Type of Crop	Seeds in INR/ha	Fertilizers & Pesticides in INR/ha	Fertilizer	Pesticide
During Kharif				
Jowar	150	2750	2300	450
Bajra	150	2450	2200	250
Tur	375	1375	1100	275
Groundnut	260	2960	2100	860
Total	935		7700	1835
During Rabi				
Jowar	150	2525	2250	275
Wheat	1800	1980	1600	380
Cotton	425	5250	2050	3200
Total	2375		5900	3855

It is assumed that human resource requirement remains the same. It is estimated that implements charges, land revenue and fodder expenses will be 3 percent, 2 percent and 10 percent of the total crop production expenditure

Water Rates

The water rates are taken as per state government norms and O&M cost are as per CWC norms. The water rate for the Kharif crop will be INR 110/ha when jowar, tur, bajra, and groundnut will be grown and for the Rabi crop will be INR 130/ha when cotton, wheat and ravi jwar will be grown. Real increase in the water rate will be 10 percent per year.

Direct Operational Cost

The direct operational cost for establishment and maintenance for the wet crop will be INR 450/ha/year while establishment and maintenance for the dry crop will be INR 150/ha/year. Real increase in operational cost /year is estimated at 3 percent.

Working Capital Details

Account Receivable	50% of Revenue
Account Payable	8.33%
Cash Balance	3.00% of O&M

Discount Rates

The discount rate for the farmers will be 8.41 percent real while for the government it will be 12 percent real.

Inflation Rate

Domestic Inflation Rate will be taken as 7 percent for the purposes of this analysis.

Depreciation Rate

The depreciation will be calculated by straight line method. The economic life of the construction and building will be 50 years while

the economic life for tools and plants is estimated as 20 years. Thus, the depreciation rates for the construction will be taken as 2 percent, for building 2 percent and for tools and plants 5 percent.

Project Life

The life of the project will be taken as 20 years for the purposes of the calculation.

Financial Analysis

For the purposes of the financial analysis, following tables were prepared:

(a) Domestic Inflation Index;

(b) Price Index of Water and other Inputs;

(c) Discount Rate Index;

(d) Production;

(e) Capacity utilization;

(f) Revenue details;

(g) Recurring cost; and

(h) Working capital details.

Analysis was first done from total investment perspective where no loan repayment was considered. Cash inflows and cash outflows both in nominal and real terms are computed. Cash inflows include water tariff collected from farmers, account receivables, salvage value of assets etc. and cash outflows include investment cost for construction, building, land, tools and plants.

With these data, net benefits are calculated and NPV (2004) nominal and real were calculated. These come to INR -9302.33 lakhs.

Financial Analysis from equity holders perspective is done where loan from NABARD and AIBP are taken into consideration. Here loan repayment is considered. Loan assistance received from NABARD and AIBP are to be repaid after a specified period of completion of project. Net benefits are calculated (including repayments) and NPV both in nominal and real terms are calculated. These come to -INR 9302.33 lakhs.

Analysis was done from beneficiaries point of view i.e., farmers perspective where incremental benefits to farmers are considered. Cash inflows and cash outflows both in nominal and real terms before and after implementation of project were computed. Cash inflows from farmer's perspective include total value of product (product of area of crops grown (kharif and rabi), yield obtained per Ha, and the cost per quintal), dung receipts, and fodder receipts. Cash outflows include Expenditure for seeds, fertilizers, labor, implementation charges, water charges and land revenue were also considered.

The results of these analyses indicate the following:

		INR (In lakhs)
NPV from Total Investment Perspective:		
	Nominal	(-) 9302.33
	Real	(-) 9302.33
NPV from Equity Holders Perspective:		
	Nominal	(-) 9302.33
	Real	(-) 9302.33
NPV from Farmers Perspective:		
	Nominal	(+) 10812.18
	Real	(+) 10812.18

Combined NPV including farmers benefit:

= (+) 10812.18+(-) 9302.33

= (+) 1509.85

Apparently, the project is not viable from the total investment as well equity points of view.

But if farmers perspective is taken into consideration, then the project appears worthwhile.

Sensitivity Analysis

Sensitivity analysis is done for all the three NPV's to see the variation with change in water rate, inflation rate, land revenue and change in account receivables and payables. A two-way analysis of land revenue and water rates was undertaken. The results of the sensitivity analysis are as follows

Water Rates: The project is sensitive to water rates. The government NPV becomes better improves with the increase of water rates and at 37 percent increase in water rates government NPV becomes positive. Farmers' NPV in any case remains positive all along.

Inflation: The project is not very sensitive to inflation. Government NPV and farmers NPV hardly changes with the change of inflation.

Account Payable and Account Receivable: There is no significant change in NPV with changes in account payable and account receivable.

Land Revenue and Water Rates: The project is not very sensitive to water rates and land revenue combined for farmers NPV as well as for government NPV. If the water rate is increased to INR 2000 per ha and land revenue increased to 25.33 percent, the government NPV will become positive.

Economic Analysis

For computing the economic NPV, conversion factors are computed for each input and output items. These conversion factors are multiplied with the financial cash flows to obtain economic cash flows.

Calculation of Conversion Factors

Conversion factors are calculated for tradable and nontradable components. Tradable items in the project are cement, steel, fuel, machines, seeds, fertilizers, agricultural implements and pesticides. And nontradable items are stone, sand bricks, fodder and labor.

Table 26: Parameters for Economic Analysis is Tabulated as Below:

Tradable

Item	Price	FEP	Subsidy	Sales Tax	Transport	Handling Charges	Excise Duty
Fertilizer/ha	100	10%	30%	8%	4%	1.25%	16%
Pesticide/ha	540	10%	30%	8%	4%	1.25%	16%
Cement/bag	165	12.50%	0%	8%	4%	1.25%	16%
Steel/MT	21000	13%	0%	8%	4%	1.25%	16%
Fuel/MT	100	13%	0%	8%	4%	1.25%	16%
Machine/MT	21000	13%	30%	8%	4%	1.25%	4%
Stone/1000	2500	0%	0%	8%	4%	1.25%	0%
Sand/Load	5000	0%	0%	8%	4%	1.25%	0%
Brick/Load	5000	0%	0%	8%	4%	1.25%	0%

Foreign exchange content for transportation and handling should be taken as 30 percent and for revenue 100 percent.

Nontradables

Item	Wage Rate	Nd	Es
Labor/ha	880	-1.20	0.40

Conversion Factor for Water

For calculating the conversion factor for water, economic value of water may be taken as .113 per cm as it is the market price as against the financial value of .021

Conversion factors calculated and used for various line items in the project are as:

Water Rate	5.38
Salvage Value	0.98
Construction	0.98
Building	0.96
Tools and Plants	0.99
Labor	1.00
Seeds	1.50
Fertilizers	0.94
Pesticides	0.97

The proportion of various items in construction, concrete works, buildings and tools and plants is indicated:

1. Construction

a) Earth Work

Materials	15%
Labor	10%
Machines	70%
Fuel	5%

b) Structures (Concrete Works)

Materials	35%
Labor	10%
Machines	50%
Fuel	5%

2. Buildings

Materials	45%
Labor	40%
Machines	10%
Fuel	5%

3. Tools and Plants

Fabricated	70%
Bought Out Items	30%

The results from such a computation indicate that the economic NPV (in lakhs) from total investment point of view and from farmer's perspective comes to:

NPV from Total Investment Perspective:
Real (-) 4988.26

NPV from Farmers Perspective:
Real (+) 7223.73

Combined NPV including Farmers Benefit:
= (+) 7223.73+ (-) 4988.26
= (+) 2235.47

Distributive Analysis

The externalities are calculated by subtracting all the line items of financial analysis from the respective line items of economic analysis and then discount the difference by the economic rate of discount (12 percent). The value of the line items indicates gainers and losers of the project as in Table 27.

Risk Analysis

Risk analysis using the Monte Carlo simulation technique, is applied to observe how the

Table 27: Project Line Item Distributive Analysis

Total Value of Product (in lakhs INR)		4019.27	
Fodder Receipt (in INR)		1076.93	
Dung Receipts (in INR)		401.93	
Expenditure on seeds, fertilizers, labor,		(268.24)	
Fodder Expenses		(401.93)	
Implements Charges		(95.62)	
Change in Accounts Payable			2.34
Irrigation Charges	570.83	(570.83)	
Land Revenue	108.16	(108.16)	

Table 28: Project Stakeholders Distributive Analysis

	Government	Farmer	Others
Construction	263.74		
Land		0.00	
Building	13.49		
Tools and Plants	2.68		
Operational Cost			
Establishment and Maintenance	1.15		
Change in Account Payable			0.02
Change in Cash			
Balance	0.00		
Total Revenue	4062.27		
Change in Account Receivables	40.13		
Salvage Value			77.08

financial and economic NPVs of the project respond to possible variation in the values of the critical variables. The probability distributions are applied for various assumptions and 50,000 simulation runs were given. Crystal Ball reports are generated. Following assumptions have been taken for doing the risk analysis:

Assumption: Capacity Utilization- Year One

Triangular distribution with parameters:

Minimum 60%
Likeliest 80%
Maximum 90%

Assumption: Capacity Utilization-Year Two

Triangular distribution with parameters:

Minimum 70%
Likeliest 95%
Maximum 100%

Assumption: Capacity Utilization- Year Three onwards

Uniform distribution with parameters:

Minimum 75%
Maximum 100%

Assumption: Increase in O&M

Normal distribution with parameters:

Mean 3%
Std. Dev. 1%

Assumption: Rabi Water Rate

Triangular distribution with parameters:

Minimum 110.00
Likeliest 110.00
Maximum 500.00

Assumption: Real Increase in Water Rate

Triangular distribution with parameters:

Minimum 0%
Likeliest 10%
Maximum 45%

Assumption: Yield Factor

Triangular distribution with parameters:

Minimum 0.80
Likeliest 1.00
Maximum 1.20

The results of the risk analysis are as follows:

The financial NPV of the farmer is always positive with the base case is 10,812.18. The probability of NPV remaining positive is 100 percent. The project is good from farmer's point of view.

The forecast for financial NPV from total investment point of view ranges from - INR 9689.47 lakhs to + INR 81454.33 lakhs with the base case is -9302.33 and the probability of its remaining positive is 9 percent. The project is not worthwhile for implementation from the financial angle.

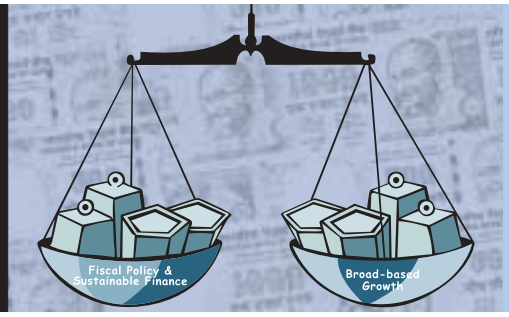
Recommendations and Suggestions

The following recommendations and suggestions are offered for making the project more attractive to all the stakeholders:

- Priority for faster completion of ongoing projects (nearing completion) by fully providing the required funds;
- Future projects are to be properly planned, appraised and funded to overcome cost overrun and time overrun;
- Revision of estimates of the projects should be avoided;
- Water rate and Land revenue to be revised periodically;
- Steps should be taken to reduce the gap between potential created and utilization on a continuous basis;
- Time frame for execution of the projects (including budget provision) should be chalked out;
- Awareness campaign to be launched to educate the farmers on proper use of water;
- Cropping pattern for optimal utilization of available water be adopted;
- User departments should make available the Guidebooks to the implementing staff;
- Issue of circulars for following the Guidebook scrupulously;
- Periodical training on project appraisal; and
- Regular monitoring by higher authorities.

The following checklist has been suggested for better project appraisal and management:

No.	Check List	YES	NO
1	Check availability of water in the command area		
2	Check technical hydrological parameters		
3	Check cropping pattern		
4	Check if analysis is done both in real and nominal terms and their NPV match.		
5	Check if NPV of Total Investment Perspective and Equity Holder Perspective are same		
6	Check if economic NPV is positive		
7	Check if risk variables have been identified with sensitivity analysis		



Water Supply Sector

Guidelines for Drinking Water Projects

Introduction

Access to improved water supply and sanitation are explicit targets of the Millennium Declaration adopted by the United Nations in 2000, and have since been a central focus of the government of India and the state governments in the country. By the year 2003, 31,008 identified habitations had been covered by potable water schemes to the extent of 99 percent. A resurvey was conducted to asses the reemerged 'not covered' (NC) and "partially covered" (PC) habitations due to the following reasons:

(a) Newly developed habitations;

(b) Insufficient discharge of water due to depletion of existing sources; and

(c) Insufficient and inefficient existing water supply system due for reorganization after completion of its period of service.

In Uttaranchal, as per survey conducted in year 2003, out of 39180 habitations 20365 habitations are already fully covered and come in the "fully covered" (FC) category while 4734 habitations are in NC and 14091 habitations are in PC category. For coverage of all these habitations as per the norms about INR 1670.00 crores will be required in 7 years to achieve the millennium goal.

Water supply projects are undertaken either to provide the minimum water demand of any habitation under scarcity of potable water by the Local Self-government or as per demand of the inhabitants of the area. If the project is prepared to meet the minimum water demand of the area under coverage, the required funds are made available as a grant by the Local Government and the project is maintained by a local body but in case of demand based projects, the project has to be maintained by the beneficiaries with their own generated resources.

A tariff can be levied for recovery of Capital Cost as well as recurring expenditure on Operation and Maintenance as per the nature of the project. In Uttaranchal State, Water Supply projects are constructed depending upon the availability of water sources: surface sources (including Ganga, Yamuna rivers and their tributaries), ground water sources and rainwater harvesting. Most of the habitations are, however, situated at higher level from the surface sources. The tapping point of surface water source at higher levels from the habitation is decided in such a way so that the habitations could receive water through pipe line network under gravity and this type of project is called gravity based. If there is scarcity of natural gravity sources at higher level and bore wells are not feasible, then pumping of water from lower level to the higher level of habitation is the only option available to benefit the habitation. Normally the pumping based projects are much more costly than the gravity system because of the high capital costs.

Different Objectives of Water Projects

Water projects may have different types of improvement as their objective:

- Convenience at a location
  - Time saving: In rural areas, if the water supply source is far away, it means additional labor and time in getting the water. Therefore, the benefit of such projects also includes the value of saving

of time and labor of those members of the household who are engaged in fetching water from far away sources.

- Reliability of supply: In absence of piped potable water, the supply of water is not assured in terms of quantity and quality. This clearly generates additional cost to the households and the economy.
  - Assured Quantity: Increased supply by time of day and season
  - Quality of water supplied
- Health Impacts: Reduction in water borne diseases and therefore savings of time that would have been lost by falling sick
  - Other Characteristics: taste, color, clarity, smell, etc
- Types of Project: Water supply projects may be of different types depending upon whether the purpose is to improve the quality or the quantity of water supply or both these aspects.
  - Quantity and convenience improvements require infrastructure to manage water storage and distribution system; for instance, dams, tanks, pipes, channels, pumps, etc
  - Quality improvement

Benefits of Improved Water

The benefits from improved water supply may be divided into two categories: private benefits to the direct consumers and benefits to others in the economy.

Private Benefits

- Price saving: If the proposed water supply is a substitute for market supply (bottled, tanker, etc).
- Cost saving: If the proposed water supply is substituting for private well and pump supply — save pumping costs if existing supply is unreliable or inadequate supply; save full costs if water supply is reliable and adequate but is costlier compared to the proposed water supply.
- Time saving: If the planed project substitutes for walking to the water source.
- Private health benefits: If it reduces incidence of water borne diseases and disabilities within consumer households.
- Improved agricultural productivity and net profits from irrigation or watershed management.
- Recreational or fishing gains from clean lakes and rivers.

Economic Externalities

- Reduced pubic sector health expenditures and social costs of lower mortality and morbidity from water borne diseases.
- Depletion of ground water or other natural water supply by excessive use or damaging watershed ability to replenish water supply.
- Cost treating sewage, polluted river/lake/ground water to different levels — boatable, fishable, swimmable/drinkable.

The Project in Uttarakhand

This project is prepared for the Kot development block of district Pauri Garhwal in Uttarakhand. It comprises 37 habitations having a population of 12326. The population under coverage is situated at 650 m. to 1750 m above the mean sea level and these habitations are spread in the hill terrain of about 75 square km.

The tariff charged by the project is as follows: Rupees 10.50 per Kilo Liter of water and Rupees 50 per household per month for water from general stand post at 2004 price level. The nominal Water tariff rate projection will be adjusted annually to reflect the inflation. For a variety of political and administrative reason, the adjustment will not be made immediately but in step by step with inflation. Once the real prices in each year have been estimated, the nominal price estimations can be made by simply multiplying the real price in a given year by the domestic inflation index for that year.

Financial Analysis

The financial net present value of the project is negative. This basically means either the construction cost is too high or that the water tariff is too low and needs to be adjusted if the project is to be undertaken by the private sector. Raising water tariff may not be a feasible option in this case because the sensitivity analysis shows that for the NPV to be zero, a very high tariff of water per household would be necessary. Thus, if both the options are not available, then the project will have to be budget funded for construction and continuously supported for the provision of operating and maintenance costs.

Sometimes, two-part or multiple-part pricing is used if the NPV is negative or if equity considerations require special type of pricing. The purpose is to improve the project viability or to provide water to the poor at affordable prices while realizing the remaining costs from those people who are more able to pay.

Two-part Tariffs: It provide powerful pricing tool to gain efficient supply and raise revenues. Below are the elements of this type of pricing.

- First-part is fixed charge per period (month, quarter).
  - Fixed charge is like an access, entry or membership fee that gives right to use or consume service. For equity reasons, the fixed charge may also be collected in installments rather than in one shot as a lump sum amount.
  - Fixed charge typically used for the recovery of fixed or capital costs. It may be broken into systems charge (water treatment plant and major trunk lines) and local access charge (cost of connecting specific consumer or group of consumers into system). Collection of fixed charges can also be built into additional property tax (or benefit tax).
- Second part is charge per unit of usage
  - This is based on metered use of service, per unit charge and is meant to cover the variable or operating costs of the water supply system.

Two-part tariff can make high fixed-cost projects financially feasible where such projects are infeasible with single usage charge. With a one-part tariff, it may be difficult to cover the average cost of water supply unless the average cost becomes prohibitive for some users in the economy.

Price Discrimination

Sometimes, price discrimination becomes necessary in case of water supply for equity reasons. In that case, it is more practical to discriminate in payment of fixed charges rather than in usage charges. One of the objectives of price discrimination is often cross subsidizing the poor sections of society by charging normal

or above market usage rates from the rich people in the society.

Economic Analysis

Since the project is partially of the commercial nature where water tariff is charged from the consumers, conversion factors are estimated to convert the financial analysis into economic analysis.

While, cement, water pipes, steel and equipment are tradable goods, bricks, sand and electricity are nontradable goods. The labor is paid wages that are 25 percent higher than their opportunity cost and consequently its conversion factor is less than one.

The economic NPV is positive and seems quite robust. Therefore, the project should be undertaken by the state sector even if it has to be budget funded.

As pointed out above, the supply of potable water has many private and public benefits. While it may not be easy to estimate all the benefits, two other aspects may be easily considered. First, health benefits to the consumers and the accompanying positive externality to the people in the neighborhood who come into contact with the beneficiaries of the project. Second, water is one of the important basic needs and therefore, the economic benefit of such projects should be augmented to reflect that characteristic.

Positive Externality

People who use piped potable water are mostly free from water borne infectious diseases and thus, they do not lose time due to falling sick from such diseases. Thus, the water supply projects have other health benefits for consumers that are normally not covered by the economic conversion factor calculations.

To estimate the additional benefits of better health, the value of time savings because the consumers do not lose time due to illness needs to be calculated. The normal period of illness from such diseases is estimated and then the loss of work days multiplied by the wage rate is taken as the health benefit of these projects.

A related benefit is that of positive externality. The consumers of piped potable water are less likely to contract fictitious diseases and in turn they are also not likely to spread the diseases to others in the society. This ultimately implies reduced morbidity and mortality rates. In terms of economic benefits, this means savings of sick days or of lives for those who might have contracted the illness and lost their income or lost their lives. The estimation of this benefit is similar to the estimation technique for direct users.

Basic Needs Externality

Since water is a basic need, if the project is supplying water to the poor sections of society, it will generate a basic needs externality. So a basic needs premium needs to be added on top of the normal economic benefits generated by the project. This premium may be kept in the range of 10-15 percent.

Estimating Benefits when No Tariffs Charged from Consumers

If a water supply project does not charge any tariffs from the users, the financial NPV would be clearly negative.

As regards the economic benefit, willingness to pay of the consumers will have to be found

through contingent valuation methods. This will involve, drawing of a sample from the user population and then find out willingness to ay through surveying the user households.

If consumers have been using alternative source water – well water, bottled water, then the prevailing price of those alternative sourced water become the measure of the economic benefit of the drinking water supplied by the project.

Kot Water Supply Project – Uttranchal Pradesh

Introduction

The national water supply and sanitation program was introduced in year 1954 with the objective to provide safe drinking water to all the rural habitations of the country through the government. In year 1972-73, the central Government launched Accelerated Rural Water Supply Programme (ARWSP) to assist the states with
100 percent grant in aid to achieve goal for providing safe drinking water to all the rural habitation. The coverage of rural habitations were carried out by state government also through minimum need program (MNP) and this challenge was taken through proper water management by a mission approach in 1986 in the name of National Drinking Water Mission (NDWM) which was renamed as Rajiv Gandhi National Drinking Water Mission (RNDWM) in 1991. The survey was conducted for identification of actually covered habitations through safe drinking water and habitations were categorized in three category named as Fully Covered (FC), Partially Covered (PC) and Not Covered (NC). The basis of coverage through safe source was as under:-

(i) Habitations which have safe drinking water source point (either private or public) within **1.6 km.** in plain or 100 meter elevation in hills providing water @ 40 lpcd are placed under FC category.

(ii) Habitations which have safe drinking water source point (either private or Public) within **1.6 km.** in plain or 100 meter elevation in hills providing water @ 10-39 lpcd are placed under PC category.

(iii) Habitations which have safe drinking water source point (either private or Public) within **1.6 km.** in plain or 100 meter elevation in hills providing water less then 10 lpcd are placed under NC category.

Access to improved water supply and sanitation are explicit targets of the Millennium Declaration adopted by the United Nations in 2000, and have since been a central focus of international cooperation, accordingly each government has been taken this in its prime agenda.

The identified 31008 habitations as per 1991 survey have been covered to the tune of 99 percent upto year 2003 and a resurvey was conducted to asses the reemerged NC and PC habitations due to following reasons:

(a) Newly developed habitations;

(b) Insufficient discharge of safe source due to depletion of existing sources; and

(c) Insufficient and inefficient existing water supply system due for reorganization after completion of its design period of service.

In Uttaranchal, as per survey conducted in year 2003 there were 39967 habitations were registered as per record, out of which 787 habitations were not found at different locations at their places and recorded as uninhabited (NN) the habitants of these habitations might have been shifted to some other places. Out of 39180 habitations 20365 habitations are already fully covered and come in FC category while 4734 habitations are NC and 14091 habitations are PC.

For coverage of all these habitations as per norms about INR 1670.00 crores will be required in seven years to achieve the millennium goal.

Project Description

Kot Water Supply Project is intended for supplying potable water for the most scarcity area of block Kot covering 37 habitations having design population 9482 in the base year 1996 (the year of commissioning) and 12326 in the design year 2011 (the design year). The appraisal of the project was conducted to find out the financial and economic viability of the project.

The details of the project are indicated below:

Population Served

Number of habitations covered in the scheme will be 37. Total Population Covered in base year 1996 and design year 2021 are 9482 and 12326, respectively. Out of the total population, males were 4645 against 4837 females. The growth rate of population is assumed to be 1.9 percent. Growth rate in per capita income is estimated as 1.3 percent.

Investment Cost

The total investment cost of the project is INR 42.55 million. These consist of land cost, civil works, plant and machinery, office buildings, consulting services, in-house engineering services including taxes. The project will be totally funded by the State Government with grants received through foreign aid agencies.

These investment costs do not include connections and tertiary networks from 1996 onward. The cost for each of these items was estimated based on the average cost for the period 1992-95. Additional cost of connection for all the 356 connections amounts to INR 47 million. Similarly, cost of secondary and tertiary distribution amounts to INR five million. Cost of connection and 10 percent cost of secondary and tertiary distribution will be met by the consumers. 80 percent of the cost will be for civil works and the remaining 20 percent for the equipment and materials.

Connection Schedule

The Water Supply Agency proposes to install 327 connections in 1996. Thereafter, it proposes to install additional two connections in 1997. Due to increased population year after year, it proposes to install one more connection every year from the previous year till the end of the project period.

The agency will also install 37 stand posts and these will be increased by one stand post every year till the completion of the project. It is expected that when the project is initiated, six persons will be served by one connection and 250 persons by one stand post. It will increase to five persons per connection as and when more connections are installed.

Per capita availability of water is projected to be 40 liters per day.

Water Tariff and Connection Charges

The charges for each connection are INR 50 per month. No tariff will be levied for community stand posts as it will serve 10 percent people living below the poverty line. The water tariff rate in the year 2004 was INR 10.5 per kl.

Operation and Maintenance Charges

Annual operating charges are INR 892 million while annual maintenance charges are estimated as INR 185 million only. Annual real increases in these charges are estimated to be 0.63 percent.

Inflation Rate

Domestic Inflation rate is assumed to be 8 percent while foreign inflation rate will be treated as 3.00 percent.

Foreign Exchange Rate

Foreign exchange rate is considered to be 1USD = INR 32.00 for 1996 prices.

Working Capital Details

(a) Account Receivable: There would be a three month lag in the revenue collection.

(b) Account Payable: There would be three months of direct expenses (O&M excluding labor) for the account payable.

(c) Cash Balances: There is a need to maintain cash balance of one month of direct expenses.

Discount Rate

Discount Rate for equity is assumed to be 12 percent.

Economic Life of the Project

The life of the project is 15 years.

Depreciation

Economic life of the building is assumed to be 50 years and economic life of the equipments may be assumed to be 15 years. The depreciation will be calculated by straight line method.

Financial Analysis

Financial analysis of the project was conducted to find out whether the project is financially viable or not. For conducting the financial analysis, following tables were made:

(a) Inflation and Exchange Rates Projections;

(b) Production, Sales Revenue;

(c) Total Costs;

(d) Working capital requirements including changes in account receivable, account payable and cash balances;

(e) Operation and Maintenance costs; and

(f) Depreciation Schedule.

From the above tables, Cash flow statement from the total investment point of view was prepared. Based on this statement NPV and IRR were calculated. It is found that NPV of the project is -INR 38.16 million. It indicates that the project loses money in its implementation.

Sensitivity Analysis

Sensitivity analysis was performed to find out the critical variables of the project. The variables tested are inflation, cost Overrun and tariff rate.

- Tariff Rate: The Net Present Value of the project is negative at tariff rate of INR 50 per connection. NPR remains negative even at a high rate of connection charges. It was found that for break even point, tariff should be enhanced to INR 2638 per connection.
- Inflation: From 4 percent inflation to 12 percent inflation, NPV changes only from -INR 38,12 million to -INR 38.28 million. The project is thus not very sensitive to inflation.
- Cost Overrun: The project is sensitive to cost overruns. If the cost increases by 50 percent, NPV gets decreased to -INR 55.14 million.

Economic Evaluation

Real economic flows are computed by adjusting the real financial cash flows from the total investment point of view using appropriate

conversion factors. Both the financial and economic analyses are expressed in domestic price. This allows the distributional impacts of the project to be estimated, by subtracting the financial values of inputs and outputs from the corresponding economic values.

Estimation of Conversion Factor:

The project uses both tradable and nontradable goods as inputs. For the construction and operation, tradable goods such as cement, steel, pipes and equipments and non transport and electricity are used. The various parameters for the calculation of conversion factors are indicated below:

Tradable

Items	CIF price	Tariff Rate	FEP	Transportation	Sales Tax
Cement/ton	300	8%	12.5%	5%	10%
Steel/quintal	2300	8%	10%	5%	4%
Pipes/meter	298	8%	10%	5%	10%
Equipment in lakhs	68	0.08	0.1	0.05	0.1

Nontradable

Item	Price	Subsidy	Sales Tax	Supply Elasticity	Demand Elasticity
Bricks (per 1000)	1800	-	5%	0.7	-1.4
Electricity per unit	2.57		4%	0.8	-1.6
Transportation per Lakhs	44		20%	0.8	-1.6
Overhead	56		20%	0.8	-1.6

As regards labor, conversion factor could be calculated by assuming that labor is being paid 20 percent higher wages than the opportunity cost of labor in the area.

The composition of various components in the construction is as follows:

Cement	20%
Steel	20%
Electricity	10%
Bricks	25%
Labor	25%

Based on the above data, conversion factors were calculated as follows:

Cement	0.84
Steel	0.98
Electricity	0.94
Bricks	0.97
Labor	0.80
Pipes	0.84
Transportation	1.07
Equipments	0.84
Overhead Charges	1.07

The economic statement of costs and benefits of the project has been prepared. It has an economic net present value of -INR 13.21 million. The economic net present value is much higher than the financial net present value, but is still negative.

Distributive Analysis

The Distributive Analysis of the Project given below: (INR In million)

Distributive Analysis (Stakeholders)	PV EXT
Total Revenue	22.35
Change in Accounts Receivable	-0.97
Salvage Value: Land	0.00
Building and Equipment	-0.20
Total Inflow	**21.18**

Cash Outflow:
Investment cost:

CIVIL WORKS a. Water Reservoirs/Pumping Stations	-1.13
b. Transmission Mains	-1.31
c. Secondary/Tertiary Networks/Lease Rent for Forest, etc.	0.00
d. Service Connections	0.00
EQUIPMENT AND MATERIALS a. Water reservoirs/pumping plant	-0.18
b. Transmission mains	-0.16
c. Secondary/Tertiary networks	-0.09
d. Service connections	0.00
OFFICE BUILDINGS	-0.11
CONSULTING SERVICES	-0.32
LAND COST Maintenance Cost	0.00 -0.08
Operating Cost	-0.39
Change in Accounts Payable	0.02
Change in Cash Balance	-0.01
Total Cash Outflow	-3.77
Net Cash flow	24.96
Out of it: Gain to Consumer	21.38
Gain to Government	3.57

Project is thus beneficial to the consumers as it provided good quality drinking water that improves their quality of life as well reduces environmental health hazards. The Government also gains as a result of increased revenue from taxes.

Risk Analysis

For the risk analysis, the following variables were selected:

Assumption: Accts. Payable

Normal distribution with parameters:

Mean 3
Std. Dev. 0.3

Assumption: Cash Balances

Normal distribution with parameters:

Mean 1
Std. Dev. 0.1

Assumption: Domestic Inflation

Normal distribution with parameters:

Mean 8%
Std. Dev. 1%

Assumption: Cost Overrun Factor

Triangular distribution with parameters:

Minimum -2%
Likeliest 0%
Maximum 15%

Assumption: Tariff Rate for Community Connection/Month

Triangular distribution with parameters:

Minimum 0
Likeliest 0
Maximum 30

Assumption: Tariff Rate for General Stand Post

Triangular distribution with parameters:

Minimum 45
Likeliest 50
Maximum 75

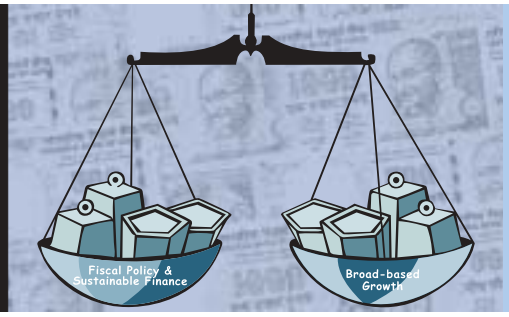
Risk analysis using the Monte Carlo simulation technique was undertaken to observe how the financial and economic NPVs of the project respond to possible variation in the values of the critical variables identified above. The probability distributions are applied for various assumptions and 50,000 simulation runs were given. Crystal Ball reports are generated and enclosed as a part of the spreadsheet.

It was found that financial NPV ranged from -INR 43.22 million to -INR 37.15 with a mean value of -INR 38.14 million. Economic NPV ranged from -INR 17.81 million to -INR 10.38 million with the base case of -INR 13.21 million It can thus be seen that the project is both financially and economically unviable.

Conclusions and Recommendations

(a) For pumping schemes, per capita cost being very high for capital cost as well as O&M cost, it is advisable to construct multipurpose projects which may include irrigation, horticulture project and micro hydro project to minimize the cost and to achieve optimum benefits by utilization of funds.

(b) The tariff should be revised to the tune of self-sustainability of scheme by the firm will of the state Government.



Agricultural Extension Sector

Guidelines for Agriculture Research and Extension: Seed Production Project

Introduction

In developing countries, a large percentage of the population lives in rural areas, where most of the people earn their livelihoods through agriculture. For the government, it is important to improve the welfare of the disadvantaged households in the rural areas and reduce poverty levels. Typically, projects in agriculture consist of research and extension activities. The evaluation of projects in agriculture ensures that the investment projects allocate the resources in the most effective manner, and benefit the disadvantaged rural households.

This is a Seed Production Program and its aim is to develop the production of food grains in Jharkhand. At present the production of food grains is less than half of the requirement for this state. The Department of Agriculture is determined to create self sufficiency in production of food grains like pulses, oilseeds and other food materials. Abundant production of food grain can only be hoped for with the use of quality seeds. Certified seeds play an important role in increasing crop production and crop quality. Keeping in view the demand of certified and improved seeds it is essential to be self-sufficient in Seed Production.

The produced certified seeds would be given to farmers of the State and it would be exchanged with their local variety for meeting the requirement of food grains of the state. If seed processing plant is established in the state government farms, it may be extended in the villages through farmers. The produced seeds will be marketed/made available to the Government/farmers keeping in view their requirement.

Financial Analysis

The seed plan requires 15 hectares of land. Different types of seeds will be required for different crops like Kharif and Rabi: for Kharif paddy seed and pulses and for Rabi mainly wheat. For Kharif, irrigation mostly depends on rain and so the cost is low about INR 500 per hect. For Rabi the irrigation requirement is higher at INR 1200 per hectare.

The selling price of paddy seed will be INR 1200 per quintal and the selling price of the straw will be INR 60 per quintal. The selling price of pulses will be INR 3000 per quintal and the selling price of wheat will be INR 1500 per quintal and straw will be INR 60 per quintal.

The Net Present Value (NPV) from Total Investment Point of View is positive and works out to INR 7.13 lakhs. If the agriculture department decided to distribute the seeds free of cost as promotional measure, the NPV would become negative. But the desirability of this project would not depend upon its financial viability but rather on economic viability. Therefore, it is important to estimate the economic viability of such projects.

Economic Analysis

Since the project charges market prices from the farmers, the real economic flows may be computed by adjusting the financial cash flows from the Total investment point of view using appropriate conversion factors.

Estimation of Conversion Factors

The conversion factor for inputs like fertilizer is calculated using traded goods model. It comes

to 1.14 when foreign exchange premium is taken into account. Similarly, the Conversion Factor of Pesticide is calculated in the similar manner and it works out to 0.91.

It is presumed that there are no distortions in the labor market because rural labor does not pay income taxes and there are no minimum wage laws being applied. Thus, the conversion factor for labor is taken as 1.00.

Total cash inflow is calculated by net sales, change in account receivable and salvage value. In cash outflow includes land investment cost and all operational cost like seed, irrigation, fertilizer, pesticides, and cost of labor.

In this project, the NPV (Economic) at the economic rate of discount of 12 percent works out to INR 6.96 lakhs.

Economic Benefit to Farmers

The ultimate beneficiaries of this project are farmers whose farm yield increases due to better seeds. The benefit to the economy is the sum of economic benefit to the agriculture department and the economic benefit to the farmers. When the economic benefit to farmers amounting to INR 36.44 lakhs is added, the total economic NPV works out to INR 43.40 lakhs.

Basic Needs Premium

If the project helps feed the poor in particular, then a basic needs premium of 10 percent-15 percent.

Should be added to the economic cash flow.

Measuring the Benefits of an Agricultural Project

In many projects, it may be difficult to measure the economic benefits of the research and extension activities. The positive externalities of the project may arise over a long period and may be dispersed over a large area, making it difficult to identify the beneficiaries and measure the benefits. In such cases, it may be appropriate to estimate the cost effectiveness of different interventions that include research and extension services.

The research and extension services have characteristics of public goods. Thus, it is often difficult to charge for these services. The financial NPV (Net Present Value) in all such cases will be negative. However, the project appraisal must ensure that the economic NPV is positive, and the project creates net additional wealth to the society.

A good agriculture project generates the following benefits:

- Increases the productivity and knowledge of the farmers;
- Introduces innovations, new practices and relevant services to the farmers;
- Increases the income of the farmers; and
- Positive externalities.

Increased Productivity

For example, an agriculture project may involve the development and distribution of new varieties of seeds that have higher yields and better quality. We can compare the productivity of the new seed varieties with the old seeds.

Innovations

Through the research and extension services, the farmers will learn about new innovations and they can apply the new ideas to increase the

yield and the quality of the crops. The extension officers have to work closely with the beneficiaries to ensure that the objectives of the project are consistent with the needs of the beneficiaries.

Income for the Farmers

The investments in agricultural research and extension services should generate additional income for the farmers. We must compare the income of the farmers with and without the agricultural interventions. The increased productivity should increase the income of the farmers.

Positive Externalities

A good agricultural project generates positive externalities that may extend beyond the boundaries of the project.

Cost-effectiveness

If the benefits are difficult to measure, then we can calculate the cost-effectiveness of the different interventions. For example, we can calculate the cost for training one farmer, and motivating him/her to use advanced techniques and inputs per hectare of land. This would tell us what is the cost per farmer and is it worth spending or not.

Risks of an Agricultural Project

In an agricultural project, there is always the temptation to overstate the expected benefits. The expected benefits should be based on robust research findings. Furthermore, the adoption rates for new innovations must be realistic and the analyst should analyze the impact of different adoption rates on the outcomes of the project.

Conclusion

Agricultural projects are very important in the overall economic development of a country, and especially in rural areas. Thus, the project appraisal must ensure that the projects use the limited resources in the most effective manner.

Seed Production Project

Introduction

The aim of the Seed Production Program is to develop the production of food grains in the nascent state of Jharkhand. At present the production of food grains is less than half of the requirement for this state. The Department of Agriculture is determined to create self sufficiency in production of food grains like pulses, oilseeds and other food materials.

Seed Production Program: Abundant production of food grain can only be hoped for with the use of quality seeds. Certified seeds play an important role in increasing crop production and crop quality. Keeping in view the demand of certified and improved seeds it is essential to be self sufficient in Seed Production.

The produced certified seeds would be given to farmers of the State and it would be exchanged from their local variety for meeting the requirement of food grains of the State.

If seed processing plant is established in the state Government farms, it may be extended in the villages through farmers. The produced seeds will be marketed/made available to the Government/farmers keeping in view their requirement.

Project Description

1. **Investment Cost of the Seed Plan** — This seed plan requires only 15 hectares of land. The cost of government land is INR 125000 per hectare. The total cost of land is expected to be INR 18.75 lakhs. Full utilization of land is expected.
2. **Operating Cost** — Direct Operational Cost: Different types of seeds will be required for one year for different crops like Kharif and Rabi.

For Kharif — the seed price of paddy will be INR 2000 per quintal and quantity of seed required is 0.5 Quintal per hectare.

The seed price of pulses will be INR 6000 per quintal and the seed requirement is 0.2 quintal per hectare.

For Rabi — The seed price of wheat will be INR 1600 per quintal and the quantity required is 1.25 per hectare.

Irrigation — For Kharif it depends mostly on rain and as per requirement there will be variation in the cost of irrigation. In Kharif there is less requirement of irrigation so the cost of irrigation for paddy is INR 500 per hectare.

For Rabi irrigation requirement will costs INR 1200 per hectare.

Fertilizer — For Kharif crop the requirement of fertilizer for Paddy will be INR 1685 per hectare and for pulses INR 1110 per hectare.

For Rabi crops as wheat the fertilizer requirement is INR 1880 per hectare.

Pesticides — For Kharif paddy pesticide requirement is INR 1000 per hectare, for pulses it will be INR 600 per hectare.

For Rabi wheat pesticides requirement will be INR 540 per hectare.

Cost of Labor — For Kharif paddy the cost of labor will be INR 13,500 per hectare, for pulses it will be INR 4200 per hectare.

-For Rabi wheat it will be INR 10, 500 per hectare.

Real increase in operation cost will be 0 percent.

3. **Pattern of Production** — In 15 hectare of land which will be utilized in seed plan, the area of paddy will be 66.67 percent, pulses 33.33 percent and wheat will be 33.33 percent. In the total yield grain will 80 percent and straw will be 20 percent. The estimated yield per hectare of paddy will be 37.5 quintal, pulses 10 quintal and wheat 37.5 quintal.
4. **Selling Price** — The selling price of paddy seed will be INR 1200 per quintal and the selling price of the straw will be INR 60 per quintal.

   The selling price of pulses will be INR 3000 per quintal and the selling price of wheat will be INR 1500 per quintal and straw will be INR 60 per quintal.
5. **Working Capital** — The working capital requirement against account receivable is for two months at the rate of 8.33 percent per month (16.66 percent) of the sales revenue, while cash in hand requirement is for one month (8.33 percent) of the operating cost and account payable is for three months for the same rate of 8.33 percent per month (25 percent) of the operating cost.
6. **Discount Rate** — The equity is 100 percent there is no loan the real equity discount rate will be 12.00 percent and the nominal equity discount rate is 18.72 percent.

7 **Rate of Inflation** — The domestic rate of inflation has been assumed to be 6 percent.

8 **Duration of the Project** — 10 years.

The aim of the Seed Production Program is to develop the production of food grains in the nascent state of Jharkhand. At present the production of food grains is less than half of the requirement for this state. The Department of Agriculture is determined to create self sufficiency in production of food grains like pulses, oilseeds and other food materials.

Financial Analysis

Based upon the assumptions, following working tables have been prepared:

- Inflation Index;
- Revenue Prices;
- Production and Revenue;
- Direct Operational Costs;
- Working Capital; and
- Investment Costs.

All the above have been prepared in nominal prices.

Then following cash flows have been prepared:

- Total Investment Point of View (Nominal); and
- Total Investment Point of View (Real).

The NPV is both the cases works out to INR 7.13 lakhs.

The detailed Analysis is placed at Annexure-I.

Sensitivity Analysis

Sensitivity Analysis was conducted to identify the Risk Variables and is placed at Annexure-I. Its salient features are:

Real Increase in Selling Price: If there is real increase in selling price, the NPV will be affected positively. If the selling price increases by 4 percent there will be increase in NPV by 57 percent for increase in price of paddy, 12 percent for pulses and 36 percent for wheat.

Real Decrease in Selling Price: If there is real decrease in selling price by 4 percent, the NPV would decrease 47 percent for paddy, 15 percent for pulses and 29 percent for wheat.

The benefit to Government is INR 0.08 lakhs and benefit to farmer is INR 0.25 lakhs if we look at it from the Government's point of view In addition to this, the farmers will get a benefit of INR 36.44 lakhs during the project life on account of increased productivity. Therefore, this project will give an economic benefit of INR 36.69 lakhs to farmers.

Real Increase in Direct Operational Cost: If there is real increase in direct operational cost like fertilizer, seeds, irrigation, pesticides, laborer etc., then if the increase is 4 percent, the NPV will decrease by 46 percent.

Economic Analysis

Real economic flows are computed by adjusting the financial cash flows from the Total investment point of view using appropriate conversion factors.

Estimation of Conversion Factors

The economic cost of foreign exchange has been used to calculate the conversion factors. The input like; fertilizer; the price of fertilizer is INR 1880 per ha, Forex premium is 12.5 percent, Subsidy 20 percent, sales tax 4 percent, Transport 4 percent of financial price, Port charges 1.25 percent of financial price, Rate of excise duty is 16 percent. Then for conversion factor of Fertilizer. Firstly, Market price of fertilizer is calculated by Financial Price / (1-Subsidy) (1+ Sales Tax). Transport charge is calculated by financial price of fertilizer multiplied by 4 percent. Similarly, port charge is calculated by financial price multiplied by 1.25 percent. CIF Price + tariff is calculated by (Market price – Transport - Port charge). CIF Price is calculated by (CIF Price + tariff * Rate of excise duty). From these values, we calculate the economic value and the conversion factor is calculated by dividing Economic Price from Financial Price, which works out to 1.14.

Conversion Factor of Pesticide is calculated in the similar manner and it works out to 0.91.

Conversion Factor of labor is taken as 1.00.

Total cash inflow is calculated by net sales, change in account receivable and salvage value. In cash outflow includes land investment cost and all operational cost like seed, irrigation, fertilizer, pesticides, and cost of labor. The Economic resource flow has been obtained by multiplying the line items of TIP (Real) by respective conversion factors.

In this project NPV (Economic) at the economic rate of discount of 12 percent works out to INR 6.96 lakhs. If we add the economic benefit to the farmers, amounting to INR 36.44 lakhs, the total economic NPV works out to INR 43.40 lakhs.

Distributive Analysis

The benefit to Government is INR 0.08 lakhs and

benefit to farmer is INR 0.25 lakhs if we look at it from the Government's point of view In addition to this, the farmers will get a benefit of INR 36.44 lakhs during the project life on account of increased productivity. Therefore, this project will give an economic benefit of INR 36.69 lakhs to farmers.

Risk Analysis

Risk Analysis was done using Crystal Ball software. The number of simulation runs was 59,000. Following assumptions were taken:

Assumption: Change in Operation Cost

Triangular distribution with parameters:

Minimum	-10%
Likeliest	0%
Maximum	10%

Assumption: Change in Selling Price

Triangular distribution with parameters:

Minimum	-10%
Likeliest	0%
Maximum	10%

Assumption: Yield Pulse

Triangular distribution with parameters:

Minimum	5
Likeliest	10
Maximum	15

Assumption: Yield Paddy/Wheat

Triangular distribution with parameters:

Minimum	20.0
Likeliest	37.5
Maximum	55.0

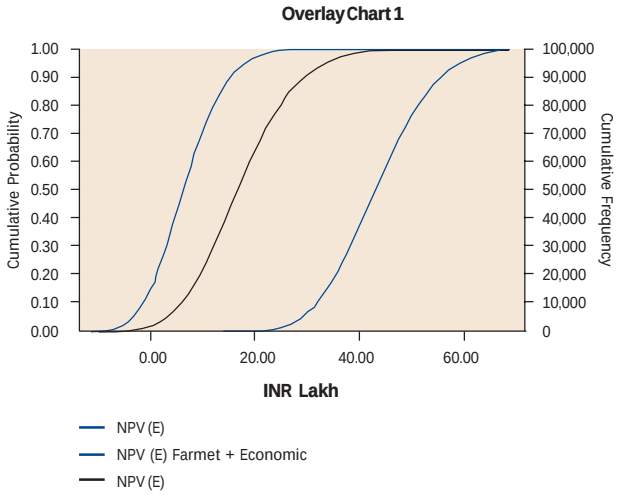
The results of risk analysis are as follows:

NPV (F): The Mean value of NPV works out to INR 7.57 lakhs, the Standard deviation INR 7.03 lakhs, the Coeff. of Variability is 0.9281. The Probability of Negative Return is 13.65 percent.

NPV (E): The Mean value of NPV works out to INR 7.40 lakhs, the Standard deviation INR 7.04 lakhs, the Coeff. of Variability is 0.9517. The Probability of Negative Return is 14.524 percent.

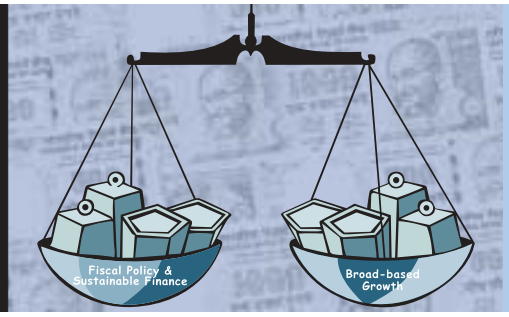
NPV (Farmer+Economic): The Mean value of NPV works out to INR 43.84 lakhs, the Standard deviation INR 9.52 lakhs, the Coeff. of Variability is 0.2171. The Probability of Negative Return is 0 percent.

The above results are given in the overlay chart.



Conclusions and Recommendations

The project is attractive both from the financial and economic points of view. It has very low probability of negative returns from Government point of view and if we add the economic benefit to the farmers, the probability of negative returns to the economy becomes zero. Therefore, this project should be implemented.



Housing Sector

Housing Sector Projects and Programs

This covers special appraisal issues relating to housing sector projects and programs. Typically, housing projects or programs are targeted at improving the housing conditions of the poor, but they may also be targeted at specific employment groups such as civil servants, military personnel or some private sector group of workers such as those working in a specific industry or mining sector.

The provision of housing involves the provision of one or all of the following assets or services:

(1) Houses, apartments or some other physical shelter;

(2) Land; and/or

(3) Infrastructure services such as water, sewage, sold waste removal, electricity or gas supply, and road or some other access or transportation services.

In some housing schemes, for example, the public sector may make serviced or unserviced plots available for purchase or lease. A savings or loan scheme may also be available to assist with the financing of the private construction. In other cases, a public agency may construct houses and then either rent or sell the properties to the members of the beneficiary group. Utilities may or may not be available to the new renters or homeowners as part of the housing scheme.

For each type of housing scheme, the costs and benefits have to be estimated for each of the key stakeholders — the beneficiaries (new renters or owners), the housing development agency, the utility development agency and the Government — and the economy as a whole. At the core of this analysis is the estimation of the private and economic value of the new housing scheme. In this valuation, it is often possible and important to separate the private and economic values of the provision of housing, land and utilities.

Private Value of Housing

A private person will value the use of a house differently depending upon whether the **person owns the property or rents the property**. **As a renter**, the private value depends upon the housing services provided (including access to the use of the land and any utilities provided at below cost). This rental value will depend upon the willingness of the renter to pay for the particular property relative to others in the market place. **As an owner**, the person will place the same rental value on the house and related services, but also get access to any capital gain from an increase in the real property value (or suffer any loss from any real decline in the property value) over the future period of ownership, and also have to pay any taxes and other fees related to purchase and owner of the property. The current private value of the house to a new owner over a year (H_t) is

$$H_t = R_t + G_t - P_t$$

where, R_t is the annual value of the housing and other services gained from use of the property; G_t is the real gain in the value of the property over the year; and P_t are any annual property taxes and other fees.

The **purchase price that the new owner would be willing to pay** is then the present value of the cash flows arising from these rental values and capital gains over the expected holding period of the property less any

transaction costs, taxes, fees etc in buying, owning and selling the property. The present value would be calculated at the weighted average cost of capital of the buyer.

When properties are sold at zero or low prices in order to target beneficiary groups in locations experiencing rising property values real capital gains are being realized. This occurs as the new owner not only gets improved housing and living conditions, but also gets the capital gain. The importance of the capital gain in property prices in financing housing schemes is discussed below.

From the **perspective of a renter**, the annual gross value of the use of the house is just the rental value (R_t). The net gain from renting is this gross value less any rental charge actually made to use the house and any costs of maintaining the house.

From the **perspective of the property developer** (which may be the Government or a government agency or private corporation), the value of the property depends upon whether it is rented out or sold. If rented, then the annual value is rental charge received plus (G_t - P_t) less any other property maintenance expenses. If sold, then the developer gains the present value of (R_t + G_t - P_t) or the amount a new owner-user of the property is willing to pay for the property.

Use of Land *Versus* Value of Land

An important caveat from the perspective of the property developer is to recognize that the capital gains on the land typically arise from factors external to the housing project. The value of the land could increase, for example, because of rising demand for land as population and incomes grow in the region or because of the introduction of utilities and other public amenities in the area by the government. To the extent that the value of the land would increase due to these exogenous factors and not due to the specific land use and property development arising from the project, then these gains should not enter into the choice of how to use or develop the land. Such capital gains would accrue to the property owner whether the land is merely held or developed in some way.

Where a property developer is deciding whether to sell land rather than use it or to purchase land for some purpose (whether holding or developing), then the present value of the capital gain over the project period must enter the decision. If the property developer already owns the land and is merely deciding on the use of the land, then exogenous capital gains should not enter the decision. For example, if a developer rents out the housing constructed on existing land, then the financial opportunity cost of the funds forgone by owning and not selling the land, should be charged against the net rental income received from the properties. The net gain from this housing project needs to be judged against other alternative uses of the land. In addition, the property ownership would generate the capital gain that is not dependent upon the housing development and rental project. This division of the costs and benefits of holding land is illustrated in Box 2.

Rental Value of Property: Market Prices *Versus* Controlled Prices

The rental value of a property, or the private value of the services of the person using the property, in a competitive market would be the market rental value paid in that location for the quality of property. In many public housing

Box 2

The cost of holding land measured as the cost of the funds invested in the land used in a project and the capital gain in the land value

The **cost of the funds invested in the land** used in a project can be estimated in two ways. For example, if land currently worth INR 100 lakhs is used in a project that lasts 10 years and the real financial opportunity cost of funds is 6 percent (or the nominal cost of funds adjusted for inflation), then the cost of the funds invested in the land can be included in the financial appraisal in two ways. The cost is either the present value of forgoing INR 100 lakhs now and regaining these funds in 10 years time (recognizing land is an asset that does not depreciate) or taking the present value of forgoing the annual financial cost of the INR 100 lakhs invested in the land. Specifically, these two approaches give the same cost of using these funds over 10 years, namely:

1. PV of funds invested in land = $-100 + 100/(1.06)^{10}$ = - INR 44.16

or

2. PV of annual financial cost of 6 percent of INR 100 lakhs or INR six lakhs each year over 10 years is INR 44.16

The real price of the land can rise over time because of increased demand arising from growth in incomes and population in the region or improves in utility services and public amenities available in the area irrespective of the specific use (such as a housing project). For example, if real land prices rise by 3 percent per year over 10 years, then, the land valued at INR 100 lakhs now would realize INR 134.4 lakhs after 10 years or a real gain of
INR 34.4 lakhs in year 10. The **present value of this real gain** at 6 percent cost of funds is **INR 19.20 lakhs.** Hence, the present value of holding the land for 10 years is the present value of the funds invested in the land less the present value of the gain, or

PV of holding land	= PV of funds in land	+	PV of capital gain
-24.95	= -44.16	+	19.20

schemes, however, market mechanisms are not used to allocate the property, particularly where no or low rental prices are charged. Where the new users of the housing experience a lower price than they were previously paying or gain access to improved housing at the same price as before (or both), then the price drop they experience gives them added consumer surplus above the rental price they actually pay for the housing. The amount of consumer surplus from the price decrease can be calculated in the standard fashion if the housing is allocated through a competitive market mechanism. Where housing is allocated to a target group on an exclusive basis at a regulated price, then the surplus over and above this regulated price will be lower as some of the beneficiaries receive housing amenities that they value less than some of the excluded persons. For example, if civil servants receive free or low rent housing, then they may be "over housed" compared to the house they would have rented themselves in a competitive housing market. In other words, they would not be willing to pay the market rental price for the housing they are provided with at now or a low rental As discussed in the case of regulated markets with quantitative restrictions on the access to the housing, the consumer surplus of the added housing will be $\frac{1}{2}(p_{MAX} - p_R)$ where p_R is the regulated rental charged to the beneficiary group, and p_{MAX} is the maximum rental a member of this group would be willing to pay for housing.

Where the scheme sells new housing to a beneficiary group at a low or no cost, then the value of housing services provided by the property to the new owner may be below the market price of the property. In such cases, the new owner has an incentive to not use the house for his own purposes, but rather to rent it out at

the market rate to capture the added rental value. Alternatively, where permitted, the new owner may sell the property to capture the added market value. The incentives to do so may be particularly strong where high expected gains are expected on the property.

Economic Value of Housing

The key issue in a housing scheme is estimating the economic value of the new housing provided to the beneficiaries. Here the economic rental value of the housing is key. The **economic rental value** is the **private rental value** (as discussed above) plus any **economic externalities**. Note, that while the capital gains expected on the property can have distributional and financing consequences, the capital gains are transfers on existing assets and not economic benefits. The **private rental value** is the **rental price paid** by the new renter plus any **consumer surplus** captured by the renter from a quality increase or price decrease. A key economic externality from housing arises where the housing is targeted at the homeless or those in temporary slum shelters. In such cases, the scheme could be credited with a basic needs externality. Other typical externalities are the property and transfer taxes paid by the developer or owner of the property.

Where the new properties are sold to the beneficiaries, the economic value is the present value of the economic rental values (excluding the capital gains and property and transfer taxes) plus the present value of any economic externalities.

Residential Accommodation for Government Employees in Ranchi

Introduction

After creation of Jharkhand a new state in Nov '2000 it was felt that there were inadequate accommodations for various categories of Govt. Employees in the state capital of Ranchi and in the other districts of the state. After the formation of Jharkhand, 4 (four) more new districts were also created resulting in more requirements of accommodations.

To cater the need, the Building Construction Department took up the schemes to construct "A", "B", "C", "D" and "E" types of quarters in every district as per requirements.

Project Description

The project appraisal for **Construction of "B", "C" and "D" type of quarters in the state Capital Ranchi**, for different categories of government employees was undertaken. By working out the Financial Analysis, Economic Analysis and Risk Analysis, the viability of the project was examined.

The cost of construction of "B", "C" and "D" type quarters has been taken as per sanctioned estimate approved by Building Construction Department. The total cost of project is INR 3,41,53,000.00.

This scheme is fully financed by the Government of Jharkhand.

The financial analysis of this project was conducted on the basis of total investment by the government and revenue generated after the completion of the project.

The main parameters assumed in this analysis are:

The Cost of Construction

The cost of construction of "B", "C" and "D" type quarters were assumed INR 76.03 lakhs, INR 110.60 lakhs, INR 154.90 lakhs respectively. The construction costs are based on the prevailing schedule of rate for Ranchi Division. These costs include the cost of civil works (Main building, Boundary wall, Approach road, etc.), sanitary installation, water supply and internal electrification works.

Cost of Land

Cost of land is assumed as per the prevailing market rate in the vicinity of the construction site, which is INR 150.00 per sq. ft. The land area required for the construction of "B", "C", and "D" type quarters are assumed as 2400 sq. ft, 2400 sq. ft and 2550 sq. ft respectively as per approved working drawing for each lot.

Details of Residential Units

As per the approved drawing "B", "C" and "D" Type blocks consist of 6 units (G+2) each having plinth area of 775 sq. ft., 1110 sft and 1525 sq. ft in each unit. For analysis purposes we have considered three (3) blocks for each type of quarters.

Brief Description of Specifications

All the units are having brick masonry, structure with R.C.C foundation, R.C.C stiffeners, R.C.C roof (all M-20 mix), mosaic flooring, presses steel chaukhat, flush doors, steel windows, oil bound distemper in interior and snoecem exterior finish. All internal electrification works and water supply fittings are concealed.

Beneficiaries

The "B" type quarters are supposed to be occupied by class III employees having an average basic pay of INR 6000 per month with an annual increment of INR 100. The "C" type quarters are supposed to be occupied by class II employees having an average basic salary of INR 8500 per month with annual increment of INR 200. The "D" type quarters are supposed to be occupied by class II senior gazetted officers having an average basic salary of INR 12750 per month with annual increment of INR 325.

Rent of Units

The rent received from the occupants of "B", "C" and "D" type units are INR 150, INR 220 and INR 300 respectively per month, which is @ INR 0.20/sq.ft. fixed by the government. The employees will not be paid the H.R.A admissible to them, which is 15 percent of their basic pay and 50 percent merged dearness pay for Ranchi.

Life of Building and Project Evaluation Period

For analysis purposes life of the building is assumed 80 years, which is quite rational for the properly maintained buildings. The project period has been assumed 10 (ten) years for simplicity and easy handling of dates.

Rate of Inflation and Discount Rate

For analysis purpose, the rate of inflation is assumed to be 5 percent and real rate of discount as 12 percent (corresponding to 17.6 percent nominal) which is based on current prevailing economy.

Maintenance Cost

For maintaining the government quarters it is assumed that government would provide INR five per sq. ft. of the plinth area after two years of construction.

Working Capital

Account Receivable: It is amount in percentage received as house rent from the occupants after 1 (one) month of occupancy, hence it is assumed as 1/12 i.e. 8.33 percent of annual revenue.

Account Payable: The government has to pay to the contractor for maintenance work. It is assumed to that the government will pay 2 (two) months of maintenance cost i.e. 16.67 percent of annual maintenance cost.

Cash Balance: It is the amount in percentage that a field officer is keeping in his hand for day to day expenditure. For analysis purposes it is assumed 1 (one) month of maintenance cost, i.e. 1/12 or 8.33 percent of annual maintenance cost.

Financial Analysis

Financial Analysis of this project is conducted from government point of view, who is stakeholder of this project. The Net Present Value (NPV) of the cash flow was calculated for which the following tables were prepared:

- Inflation index;
- Revenue received from rent;
- Maintenance cost; and
- Investment cost of land and construction.

With the help of above data's cash inflow, cash outflow and net cash flow tables were prepared and NPV (Net Present Value) and IRR (Internal Rate of Return) from the net cash flow were obtained taking rate of discount as 17.6 percent (Nominal) for all three type of residential units.

Similarly NPV (Real) and IRR (Real) were estimated taking rate of discount as 12 percent (Real).

After working out the financial analysis we found that the NPV of the project was INR 183.52 lakhs (Negative), which represents that the project is not financially viable.

Sensitivity Analysis

Sensitivity analysis of financial NPV has been carried out taking variables as rent of building, rate of repair, construction cost and cost over run factors.

Some results can be seen in Table 29.

It is apparent from the sensitivity analysis table that the NPV of the project can be positive if cost of construction is reduced and rent chargeable is increased substantially, which is not possible from all practical purposes. Dilution of specifications, for reducing the cost of construction, to such an extent, is also not practical.

Effect of reducing the repair cost was also studied and found that its impact on NPV is not significant.

Economic Analysis

For economic analysis of the project real economic cash flow were computed by adjusting the real financial cash flow with appropriate conversion factor. For estimation of conversion factor first of all, both tradable and nontradable items were considered.

Estimation of Conversion factors

In this case, cement, steel and others like paint, electrical fittings, and sanitary fittings are considered tradable items, where as bricks, labors are considered as nontradable items. The exchange rate is assumed to be 1 USD=INR 44. The price of cement is INR 165 per bag while the price of steel is INR 31,000 per MT. Values of the items such as market exchange premium, sale tax, excise duty, handling charge, transportation cost etc can be seen in Table 30:

For nontradable items, such as bricks, the elasticity of demand and elasticity of supply of construction materials as -1 and 3, respectively while for labor these are -1.20 and .40, respectively.

For calculation of combined conversion factor for construction cost of building, it is assumed that main component such as cement, steel, bricks, labors and others have contribution of 10 percent, 10 percent, 10 percent, 30 percent and 40 percent, respectively.

For calculation of combined conversion factor for repair of building, it is assumed that material component is 45 percent and labor component is 55 percent.

Table 29: Building Rent Senstivity Analysis

	"B" TYPE	"C" TYPE	"D" TYPE
Rent of Building			
Actual Rent Charged	150	220	300
Rent to be Charged for (+) NPV	3630	5228	7007
Cost of Construction			
Actual Cost of Construction	7603000	11600000	15490000
Cost of Construction for (+) NPV	1947931	2995274	4690071

Table 30

Market Exchange Premium	Sale Tax	Excise Duty	Handling Charge	Transportation Cost
12.5%	8% for cement and steel & 9% for others	16%	1.5% for cement & 2% for steel and others	2.5% for cement and others & 3% for steel

For calculation of combined conversion factor for rent of building prevailing market rate @ INR 5.00/sq.ft. with an annual growth of INR 0.25/ sq.ft. has been assumed.

From the above methodology, the following conversion factors for different type of residential units were arrived at:

Building construction: 0.92
Building repair: 0.95
Rent "B" type building: 2.99
"C" type: 2.93
"D" type: 2.69

With the help of above conversion factors, Economic cash flow is prepared. NPV (Real) of this project comes to be INR 3.11 lakhs (positive) with a discount rate of 12 percent which means that the project is economically viable.

Risk Analysis

Risk analysis of this project is done using Monte Carlo simulation technique to estimate as to how the financial and economic NPV of the project respond to possible variations in the value of critical variables like (i) Rate of inflation; (ii) Cost of construction; (iii) Repair cost; (iv) Rent payable; (v) Market rent; and (vi) Cost over run factor with distributions as shown in Table 31.Risk Analysis report after getting 50000 run Monte Carlo simulations shows that the financial Net Present Value has no possibility of becoming positive. On the other hand, the Economic Net Present Value has possibility i.e. 69.5 percent, 67 percent, 60 percent of becoming positive for "B", "C" and "D" type quarter, respectively.

"B" Type Quarters

Table 31

Risk Variable	Basic Value	Probability Distribution	Range Value
Rate of Inflation	5%	Triangular	5-8
Cost of Construction	INR 7603000	Normal	
Repair Cost	INR 5/sq. ft.	Normal	3-7
Rent Payable	INR 155/month	Triangular	155-500
Market Rent	INR 5/sq. ft.	Triangular	4-8
Cost Overrun Factor	0%	Triangular	0-10%

"C" Type Quarters

Table 32

Risk Variable	Basic Value	Probability Distribution	Range Value
Rate of Inflation	5%	Triangular	5-8
Cost of Construction	INR 11060000	Normal	
Repair Cost	INR 5/sq. ft.	Normal	3-7
Rent Payable	INR 220/month	Triangular	220-750
Market Rent	INR 5/sq. ft.	Triangular	4-8
Cost Overrun Factor	0%	Triangular	0-10%

"D" Type Quarters

Table 33

Risk Variable	Basic Value	Probability Distribution	Range Value
Rate of Inflation	5%	Triangular	5-8
Cost of Construction	INR 15490000	Normal	
Repair Cost	INR 5/sq. ft.	Normal	3-7
Rent Payable	INR 300/month	Triangular	300-1000
Market Rent	INR 5/sq. ft.	Triangular	4-8
Cost Overrun Factor	0%	Triangular	0-10%

Figure 5.1

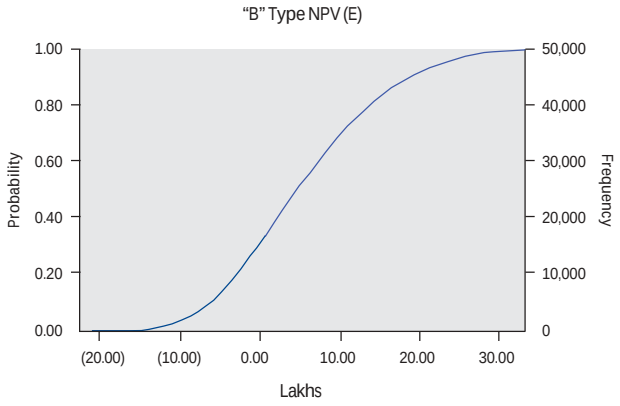


Figure 6

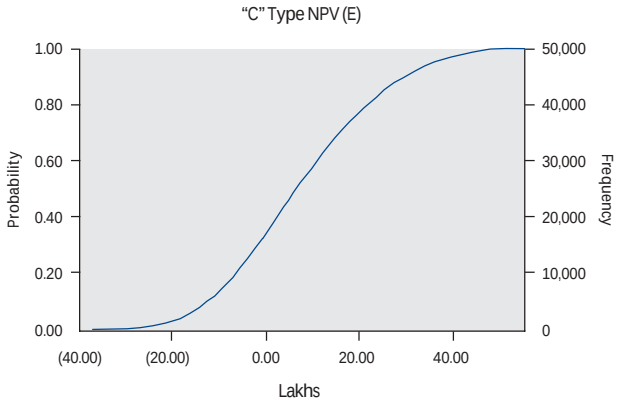


Figure 7

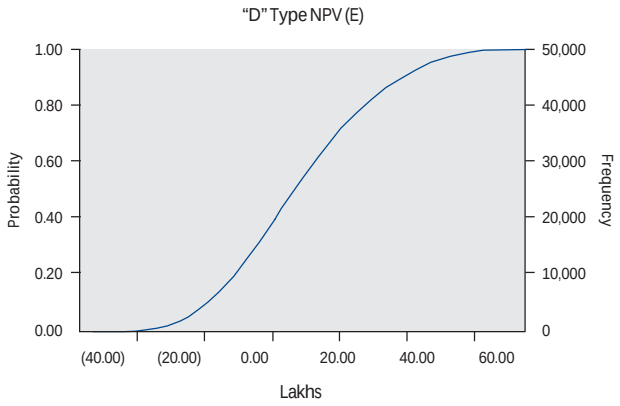


Figure 8

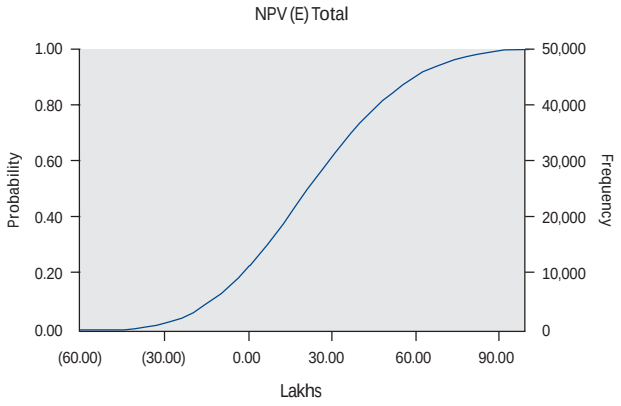


Figure 9

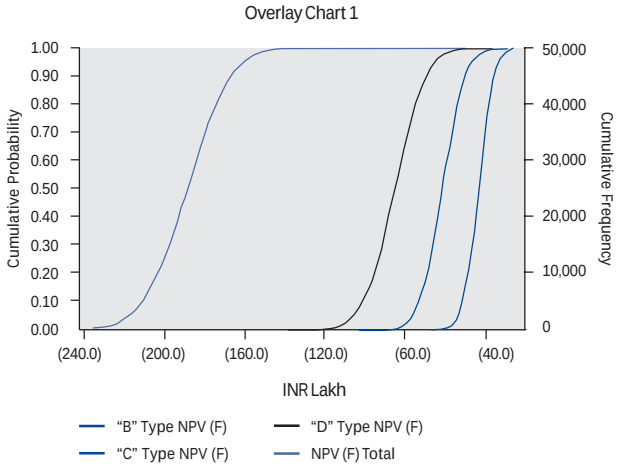
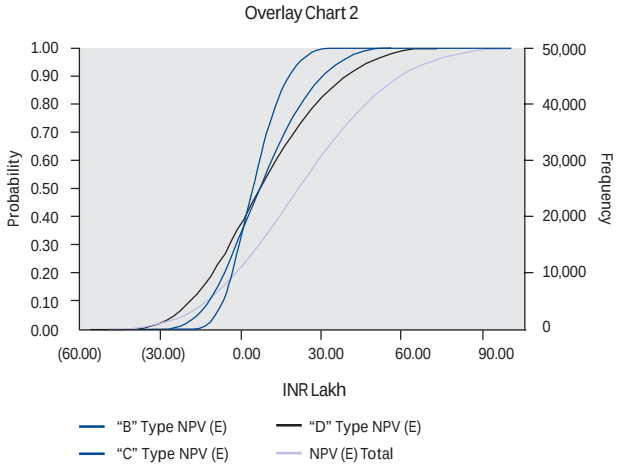


Figure 10

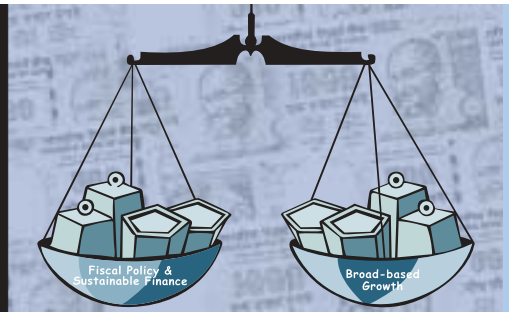


For distributive analysis a cash flow chart is prepared on the basis of cash flow of financial analysis and economical analysis.

For estimating externalities of the project, values of economic analysis are subtracted from financial analysis and then NPV of each item is calculated. From the above calculation, we infer that this project has total externalities of INR 200.66 lakhs. The major share of these externalities i.e. INR 165.30 lakhs goes to employees where as INR 28.35 lakhs goes to the Government and INR 7.02 lakhs to others.

Conclusions and Recommendations

1. Construction of government quarters for employees and making them available at subsidized rates are not viable from financial point of view.
2. Instead of constructing houses, it is better for the government to increase house rent allowance (H.R.A) to the employees as in private or public sectors establishments based on actual market rent for accommodation.
3. Government should take up such projects only at those places where there is no other alternative option for the accommodation of the employees.



Tourism Sector

Guidelines for Tourism Projects

Introduction

In many regions, tourism projects can be important components of the overall strategy for economic development. This specially applies to Uttarakhand which has large scale pilgrimage touring throughout the year. Also, a large number of foreign tourists are attracted to the region who come for trekking during the summer and skiing in the Himalayan ranges during the winter.

A successful tourism project requires the development of appropriate infrastructure and other facilities, such as all-weather roads, communications, hotels and shopping complexes, to meet the needs of a wide range of tourists, both domestic and international.

Wherever feasible, the tourism project can collaborate with the private sector. The private sector has special experiences and strengths, and the participation of the private sector may improve the performance of the project.

Normally, tourism projects should be financially viable because the tourists are willing to pay market prices for the facilities and service made available to them. The problem will come up when the government begins to impose controlled prices for the benefit of tourists and for attracting more tourists. If the tourism project is financially viable, then it will attract the participation of the private sector. In the longer term, the involvement of the private sector improves the sustainability of the project. Even if the financial NPV (Net Present Value) is not positive, the analyst must verify that the economic NPV is positive for the project to be undertaken by the private sector.

The Project

The large influx of tourists in the State requires good infrastructure facilities like proper accommodations with multipurpose shopping complexes, all weather roads, good communications etc in all the tourist places of the State so that the visiting tourists do not face unnecessary difficulties during their visits. To this end, good quality Hotels and Tourist Bungalows are required to be constructed in all the places of popular tourist destination because most of these places are deficient in these facilities to day. To cater to their needs, it is proposed to construct a suitable budget hotel or tourist Bungalow having multipurpose shopping complex in Gairsain, District Chamoli, Garhwal.

This project relates to a 200 bedded suitable budget hotel or tourist Bungalow having multipurpose shopping complex at Mussoorie. The complex is being constructed to cater for the accommodation and shopping facilities for visiting tourist as well as the local population. The project is organized on commercial lines both in terms of services and facilities (operating and maintenance expenditures) and the tariff charged from the tourists. The tariff structure, rates of food items, etc., are determined by the type of quality and facility provided by comparative hotels and restaurants in Mussoorie.

Financial Analysis

The financial analysis is conducted from the total investment point of view, which gives overall financial feasibility of the project. The net present value for total investment point of view is INR 81.05 lakhs. This clearly indicates that the project is profitable as shown by high net present value.

Economic Benefits of Tourism

For economic analysis of the project, real economic cash flow are computed by adjusting the real financial cash flow with appropriate conversion factor. For estimation of conversion factors, tradable and nontradable items related to this project are separated and then their conversion factors are calculated. The Economic NPV of this Project works out to INR 48.49 lakhs. Thus the project is viable both financially and from the point of the economy.

If the project were not operated commercially, then the economic benefits would have to be calculated indirectly, i.e. by looking at the benefits generated by the project on different stakeholders.

Tourism projects generate the following economic benefits:

- Contributes to economic development in the region; and
- Promotes the development of related services.

Economic Development

Successful tourism projects can contribute to economic development of the region. The problem is to identify these developments that are specifically due to the project in question.

Related Services

Tourism projects help to develop tourism related services and the benefits derived by the vendors become the benefit to the economy.

Risks of Tourism Projects

For tourism project, the "demand module" or market research is most important. In other words, it should research and analyze the characteristics of the tourism market, and the demand of the tourists in terms of sightseeing, outdoor activities and accommodations. Also, the needs of the domestic tourists may be different from the needs of the international tourists.

Budget Hotel Cum Shopping Complex in Uttranchal Pradesh

Introduction

The Tourism Sector plays a very important part in the economy of the newly created State of Uttaranchal. The snowcapped Himalayas, the scenic beauties of picturesque mountains and vallies spread over the width and length of the State, the religious sanctity of the Char dham shrines of Yamunotri, Gangotri, Kedarnath and Badrinath, Hemkund, Meetha Reetha Sahib, Piran Clare, the confluences of holy rivers, the beautiful meadows called Bugyals, the holy cities of Rishikesh and Haridwar, the favorite tourist destinations like Nainital, Mussoorie, Kausani, Dehradun, Munsiyari, Pithoragarh, Pauri, Ranikhet, Almora, Bageshwar, New Tehri, Chakrata, Lansdowne, Gairsain, Thalisain, etc., are the unique selling points of the beautiful hilly state of Uttaranchal which have been attracting the huge numbers of tourists both from within and out side of the country since time immemorial.

The large influx of tourists in the State requires good infrastructure facilities like proper accommodations with multipurpose shopping complexes, all weather roads, good communications, etc., in all the tourist places of the State so that the visiting tourists do not face unnecessary difficulties during their visits. To this end, good quality Hotels and Tourist Bungalows are required to be constructed in all the places of popular tourist destination because most of these places are deficient in these facilities to day. To cater to their needs, it is proposed to construct a suitable budget hotel or tourist Bungalow having multipurpose shopping complex in Gairsain, District Chamoli, Garhwal.

Project Description

The main purpose of this project is to prepare a project appraisal report for the construction of a 200 bedded suitable budget hotel or tourist Bungalow having multipurpose shopping complex at Mussoorie for undertaking a detailed financial and economic analysis of the proposed project. The Project consists of a tourist bungalow having multipurpose shopping complex at Mussoorie. The complex is being constructed to cater for the accommodation and shopping facilities for visiting tourist as well as the local population.

Facilities at the Budget Hotel Complex:

The tourist complex will consist of 30 single rooms, 10 double rooms, two dormitory that can accommodate 20 persons, one staff rooms, one conference hall and Exhibition hall and a restaurant. The restaurant consists of a dining hall and a kitchen. The state of furniture and fixtures provided in each room as well as in restaurant is given in Annexure A of the spreadsheet.

The Size of Investment:

The complex will be housed in a lot of 5000 square meters. The current land cost is INR 2000 per square meters. This land has been provided as subsidy from the State Government for the promotion of tourism in the state. The complex will have two floors. The constructed area for the first floor will be 3000 square meters while for the second floor it would be 2000 square meters.

The project will be constructed using latest construction technologies in consultation with the reputed designer Architect. Earthquake

resistant designs will be an integral part of the overall construction plan. The cost of construction per meter will be INR 7000 for the first floor and INR 5000 for the second floor. The construction of the project will be completed in two years time with half the construction completed each year.

In addition, cost of machinery including refrigerators, air conditioners, Coolers, Water Purifier, Water Pump, Generator and Solar Heater is estimated to cost INR 3,500,000. The complex will also require a vehicle costing INR 5 lakhs only. Other equipment and fitting are expected to cost INR 100,000 only. Insurance will cost 2 percent of the total equipment and vehicle cost.

The breakdown of furnishing cost is given year wise as follows:

Table 34: Furnishing Cost Breakdown

Items	Number Required	Unit Price in INR
Beds	70	1200
Chairs	145	400
Tables	55	600
Mattresses	60	1500
Bed Sheets	120	350
Bed Covers	70	750
Pillows	70	200
Pillow Covers	90	50
Blankets	90	600
Curtains	90	350
Dressing Tables	42	2000

Financing of the Project

The total project cost is INR four crores 80 lacs at current price level. The entire project will be fully financed by Government of Uttaranchal through its budgetary provisions.

Occupancy

The tourist complex will operate at 75 percent occupancy during the peak tourist period, and 35 percent during the lean period during its first year of operation. This occupancy will vary from year to year. During the peak period, the occupancy will remain at 75 percent for the first two years, 80 percent during the next three years and 85 percent in the sixth year. It will increase to 90 percent thereafter, and continue through the project period. Similarly, during the lean period, the occupancy will remain at 35 percent during the first year, 40 percent during the second year, 45 percent during the third year and 50 percent during the fourth year. It will increase to 60 percent thereafter; and continue through the project period. The average tourism peak period for summer is four months and for winter is two months (at the time of snowfall). The occupancy rate to 90 percent in peak period and 65 percent in lean period is conservatively assumed for the project life.

The life of the project is assumed to be 15 years.

It is assumed that all the tourists staying in the complex will avail the facility of restaurant all the time besides local people will also utilize restaurant facility which is about 15 percent of the average occupancy of the hotel.

The average occupancy of shops, conference hall and exhibition hall is assumed to be 100 percent.

Tariff and Rental Structure

The tariff structure, rates of food items etc are determined by the type of quality and facility provided by the hotels and restaurants in Mussoorie.

The details of tariff, rent of slops, rates of food items and fee of conference and exhibition hall are given as follows:

Table 35: Tariff Details

Single Room	30	800	Daily
Double Room	10	1,400	Daily
Dormitory	2	100	Per Bed Daily
Rent of Shops	10	4,000	Monthly
Rent of Exhibition Hall	2	15,000	Monthly
Conference Hall	1	20,000	Monthly
Income from Restaurant		150	Per Head Daily

Recurrent Cost Parameters

(a) Furnitures and Fixtures Cost such as mattresses, beds, tables, chairs, dressing table etc are to be replaced every four year.

(b) Ration Expenditure is assumed to be INR 75 per person.

(c) Linen such as bed sheets, bed covers, pillows, pillow covers, blankets and curtains are to be replaced every two years.

(d) Kitchen equipment will cost INR 1 lakh every year.

(e) Other Perishable items are estimated to cost INR 50,000 in the first years and 25 percent of such items will be replaced every year.

Operation and Maintenance

Salary — The complex will employ 10 labor, the average monthly salary of which will be INR 3500. per month.

Administrative Expenses — Administrative expenses such as salary of hotel personnel, telephone and electricity bill and other incidental will be computed as 12 percent of the total income.

Repair and Maintenance — It is assumed as 2 percent of the construction cost.

Working Capital Details (Account Receivables, Accounts Payable, Cash Balance, and Inventory Details)

Assumption about inventories, levels of accounts receivable, payable, cash balances and other operating costs redetailed as follows:

(a) Accounts receivable may be assumed as 15.00 percent of rent of shops;

(b) Accounts payable may be considered as 8.33 percent of direct costs; and

(c) Cash balance should be taken as 25.00 percent of restaurant income.

Discount Rates (Financial and Economic)

The financial rate of discount (real) has been taken at 12 percent and the economic rate of discount has also been assumed at 12 percent.

Rates of Inflation (Domestic and Foreign)

It is assumed that domestic inflation will remain stable at around 8 percent per annum on an average for the life of the project. The prices of output and all the inputs are expected to remain constant in real terms so that price increase will simply follow the rate of inflation.

Foreign Exchange Premium

The FEP has been taken as 12.5 percent for calculation of conversion factors of Tradable Goods.

Taxes

The complex starts paying tax from the first year of operation till the useful life of the project. The corporate tax (Income Tax) has been taken as 33 percent, luxury Tax as 8 percent; trade tax as 4

percent/8 percent and for Vehicles excise duty and trade tax has been taken as 30 percent.

Life of the Project

The economic life of the project has been estimated 15 years.

Depreciation Value

The SLM depreciation rate has been taken as 6.67 percent for plants and machinery, motor vehicles, other equipments and fittings and 2 percent for buildings.

Income Tax Depreciation Rate

The Income Tax Depreciation rates have been taken as 33.33 percent for plants and machinery, motor vehicles, other equipments and fittings and buildings. The useful life of plant and machinery and other equipment and fittings is 10 years while for the vehicle, it is assumed to be five years.

Investment Schedule

The year-wise investment cost has been given:

Investment Costs	In INR Ist Year	IInd Year
Construction Cost 1st floor	10,500,000	11,340,000
Construction Cost 2nd floor	5,000,000	5,400,000
Total Construction Cost	15,500,000	16,740,000

Financial Analysis

For conducting the financial analysis of the project, the following working tables are to be prepared:

(a) Domestic Inflation Index;

(b) Revenue Table;

(c) Investment and Operating Cost;

(d) Working Capital;

(e) Depreciation Schedule (For Salvage value and Income Tax);

(f) Income Tax Table;

(g) Cash flow from Total Investment Perspective (Nominal);

(h) Cash flow from Total Investment Perspective (Real);

(i) Calculation of NPV; and

(j) Sensitivity Analysis.

The financial analysis is conducted for government point of view (Total investment point of view), which gives overall financial feasibility of the project. The Net Present Value for total investment point of view is INR 81.05 lakhs.

The pro forma cash flow statement from the total investment point of view is first developed for nominal terms in order to take into account the effects of inflation. The cash flow are then deflated to arrive at their real values. Finally the real net cash flow are discounted by the real overall cost of capital of 12 percent to get the net present value of INR 81.05 lakhs.

The cash flow profile of the project from the total investment point of view is presented in chart. This clearly indicates that the project is profitable as shown by high net present value.

Sensitivity Analysis

Sensitivity analysis was conducted for the project taking into the consideration parameters such as change in base rent (%), labor cost, luxury tax, overhead, annual replacement items and casual visitors. It was found that the project was sensitive to changes in base rent, luxury tax, and overheads and somewhat to ration expenditure. Other

parameters such as labor cost and annual cost do not make significant difference to financial NPV.

Economic Analysis

For economic analysis of the project real economic cash flow were computed by adjusting the real financial cash flow with appropriate conversion factor. For estimation of conversion factor first of all, we separate tradable and nontradable items related to this project.

Calculation of Conversion Factors

In construction, tradable items are cement, steel, wood and plant and machinery. Their components in the total construction are estimated to be 49 percent. Their compositions, transportation charges, taxes and duties, foreign exchange premium etc are indicated as:

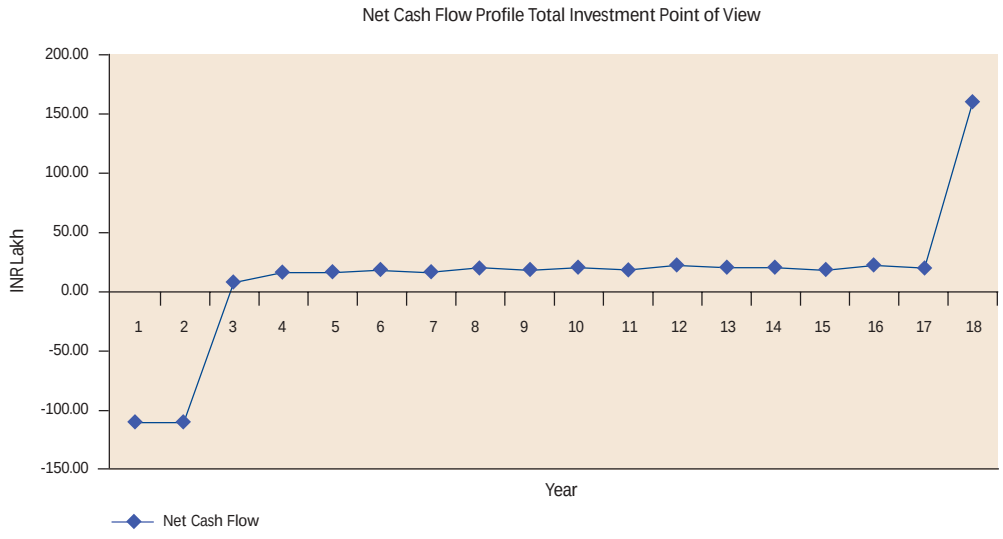
Construction		Trans-portation	Tax %	FEP	Tradable
Tradable Items	49%	of Total Cost			
Wood	10%	10%	4%	10%	70%
Cement	10.00%	10.00%	10%	10%	70%
Steel	14.00%	10.00%	8%	10%	70%
Plant & Machinery	15%	10%	15%	10%	70%

Nontradable items of construction are bricks and mortar, sand and labor and constitute 51 percent of the total cost. For nontradable items conversion factors were calculated considering elasticity of demand and elasticity of supply of construction materials. Their compositions, taxes levied on them and supply and demand elasticities are indicated:

Table 36: Construction Material Cost Breakdown

Nontradable Items	51%	of Total cost	Tax %	Es	Ed
Bricks and Marble	20%		4%	0.8	-2
Sand	3.00%		2%	0.8	-2
Labor (skilled/Unskilled)	28%		0%		

Figure 11



Among the other items, motor vehicle is treated as tradable and parameters are indicated below for calculation of conversion factor. Among nontradables, administrative expenses and expenses on furnishing and fixtures are considered. Parameters for calculations of conversion factors are indicated below.

Table 37: Calculations of Conversion Factors

Other Tradable Items		**Transportation**	**Tax %**	**FEP**	**Tradable**
Motor Vehicles	100%	10%	30%	10%	70%

Other Nontradable Items					
Administration/ Salary/Elect/WC/Tel	12%	of Total revenue			
Administration/ Salary/	9%		10%	0.8	-1.5
elect/	2%		0.01%	0.8	-0.9
WC/Tel	1%		8%	1.5	-1.5
Furnishing					
Furniture and Fixtures			4%	2	-1.8
Kitchen Equipment			8%	1	-2
Other Perishable Items			4%	2	-2
Labor			0%	0.5	-0.5
Repair and Maintenance			4%	2	-2
Ration Exp.			4%	1	-2
Linen			4%	1	-2
Revenue					
Rent from Single Rooms			8%	1	-3
Rent from Double Bedrooms			8%	1	-3
Dormitory			8%	1	-3
Rent of Shops			8%	1	-3
Rent of Exhibition Hall			8%	1	-3
Conference Hall			8%	1	-3
Income from Restaurant			8%	1	-3

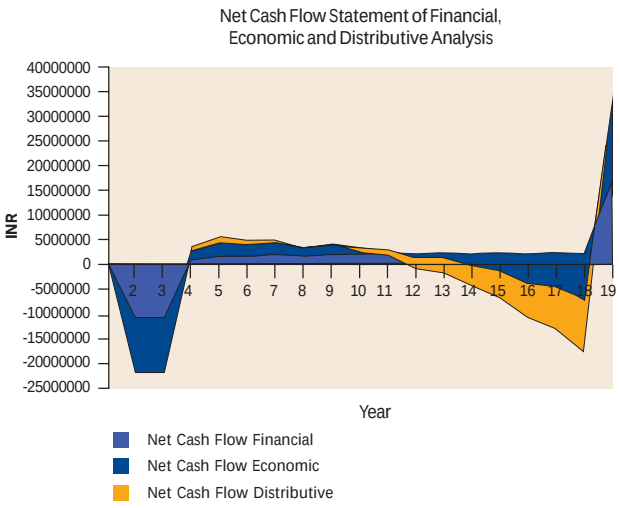
Conversion factors are calculated based on the above parameters are as follows:

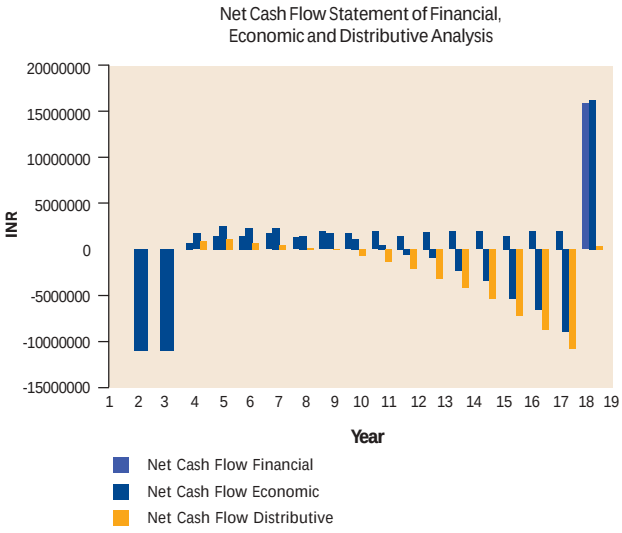
Table 38: Construction Project: Conversion Factor Results

	CF
Construction	
Wood	1.06
Bricks and Marble	0.99
Cement	1.01
Steel	1.02
Sand	0.99
Labor (Skilled/Unskilled)	1.00
Plant and Machinery	0.97
Total	**1.01**
Administration/Salary/elect/WC/Tel	
Administration/ Salary/	0.97
elect/	1.00
WC/Tel	0.96
Furnishing	
Furniture and Fixture	0.98
Kitchen Equipment	0.98
Other Perishable Items	0.98
Labor	1.00
Repair and Maintenance	0.98
Motor Vehicles	0.87
Ration Exp.	0.99
Linen	0.99
Revenue	
Rent from Single Rooms	1.07
Rent from Double bedrooms	1.07
Dormitory	1.07
Rent of Shops	1.07
Rent of Exhibition Hall	1.07
Conference Hall	1.07
Income from Restaurant	1.07

Then, the each line item of TIP (real) is multiplied by the respective CFs in order to get the economic resource flow (ERF). The Net ERF is discounted by 12 percent in order to get the NPV Economic. It may be mentioned that economic rate of discount is a national parameter (like FEP). The Economic NPV of this Project works out to INR 48.49 lakhs.

Year-wise net cash flow statement of Financial, Economic and Distributive analysis is shown in following Graphs:





Distributive (Stakeholders) Analysis

The distribution of economic benefit to various stakeholders is given below:

Table 39: Distributive Analysis (Amount INR in lakhs)

	Economy	Project	Others
Total Revenue		59.85	
Change in Account Receivable		-2.06	
Salvage Value			14.56
Total Investment Cost			0.37
Operating Cost			224.73
Change in Account Payable		4.94	
Change in Cash Balance		-10.70	
Income Tax	155.08		
Total	**155.08**	**52.03**	**239.66**
NPV (Externality)	**-32.56**		

Risk Analysis

Risk analysis of this project was done using Monte Carlo simulation technique to observe, how the financial and economic NPVs of the project respond to possible variations in the value of critical variables. Based on Sensitivity Analysis following Risk Variables (Assumption) were defined as follows:

Assumption: Administration/ Salary

Normal distribution with parameters:

Mean 12%
Std. Dev. 1%

Assumption: Annual replacement 25% of initial value

Triangular distribution with parameters:

Minimum 15%
Likeliest 25%
Maximum 28%

Assumption: Casual Visitors

Triangular distribution with parameters:

Minimum 14%
Likeliest 15%
Maximum 17%

Assumption: Dormitory

Normal distribution with parameters:

Mean 100
Std. Dev. 10

Assumption: Rent of Shops

Triangular distribution with parameters:

Minimum 3,600
Likeliest 4,000
Maximum 5,000

Assumption: Rent of Exhibition Hall

Normal distribution with parameters:

Mean 15,000
Std. Dev. 1,500

Assumption: Rent of Conference Hall

Normal distribution with parameters:

Mean 20,000
Std. Dev. 2,000

Assumption: Income from Restaurant

Triangular distribution with parameters:

Minimum 140
Likeliest 150
Maximum 180

Assumption: Occupancy Peak Period 2nd year

Normal distribution with parameters:

Mean 75%
Std. Dev. 8%

Assumption: Occupancy Lean Period 2nd year
Normal distribution with parameters:

Mean	40%
Std. Dev.	4%

Assumption: Occupancy Peak Period 3rd year
Normal distribution with parameters:

Mean	80%
Std. Dev.	8%

Assumption: Occupancy Lean Period 3rd year
Normal distribution with parameters:

Mean	45%
Std. Dev.	4%

Assumption: Occupancy Peak Period 4th year
Normal distribution with parameters:

Mean	80%
Std. Dev.	8%

Assumption: Occupancy Lean Period 4th year
Normal distribution with parameters:

Mean	50%
Std. Dev.	4%

Assumption: Occupancy Peak Period 5th year
Normal distribution with parameters:

Mean	80%
Std. Dev.	8%

Assumption: Occupancy Lean Period 5th year
Normal distribution with parameters:

Mean	60%
Std. Dev.	4%

Assumption: Labor Cost
Triangular distribution with parameters:

Minimum	3,150.00
Likeliest	3,500.00
Maximum	3,850.00

Assumption: Lean Period
Normal distribution with parameters:

Mean	35%
Std. Dev.	4%

Assumption: Occupancy Peak Period 6th year
Normal distribution with parameters:

Mean	85%
Std. Dev.	9%

Assumption: Occupancy Peak Period 6th year
Normal distribution with parameters:

Mean	60%
Std. Dev.	4%

Assumption: Occupancy Peak Period 7th year
Normal distribution with parameters:

Mean	90%
Std. Dev.	9%

Assumption: Occupancy Lean Period 7th year
Normal distribution with parameters:

Mean	60%
Std. Dev.	4%

Assumption: Occupancy Peak Period 8th year
Normal distribution with parameters:

Mean	90%
Std. Dev.	9%

Assumption: Occupancy Lean Period 8th year
Normal distribution with parameters:

Mean	65%
Std. Dev.	4%

Assumption: Occupancy Peak Period 9th year
Normal distribution with parameters:

Mean	90%
Std. Dev.	9%

Assumption: Occupancy Lean Period 9th year

Normal distribution with parameters:

Mean	65%
Std. Dev.	3%

Assumption: Peak Period 1st year

Normal distribution with parameters:

Mean	75%
Std. Dev.	8%

Assumption: Occupancy Peak Period 10th year

Normal distribution with parameters:

Mean	90%
Std. Dev.	9%

Assumption: Occupancy Lean Period 10th year

Normal distribution with parameters:

Mean	65%
Std. Dev.	3%

Assumption: Occupancy Peak Period 11th year

Normal distribution with parameters:

Mean	90%
Std. Dev.	9%

Assumption: Occupancy Lean Period 11th year

Normal distribution with parameters:

Mean	65%
Std. Dev.	3%

Assumption: Ration Exp. per head

Triangular distribution with parameters:

Minimum	63.00
Likeliest	70.00
Maximum	77.00

Assumption: Rent of Double Room

Normal distribution with parameters:

Mean	1,400
Std. Dev.	70

Assumption: Repair and Maintenance 2% of Construction Cost

Normal distribution with parameters:

Mean	2%
Std. Dev.	0%

Assumption: Occupancy Peak Period

Normal distribution with parameters:

Mean	90%
Std. Dev.	9%

Assumption: Occupancy Lean Period

Normal distribution with parameters:

Mean	65%
Std. Dev.	3%

Assumption: Single Room Rent

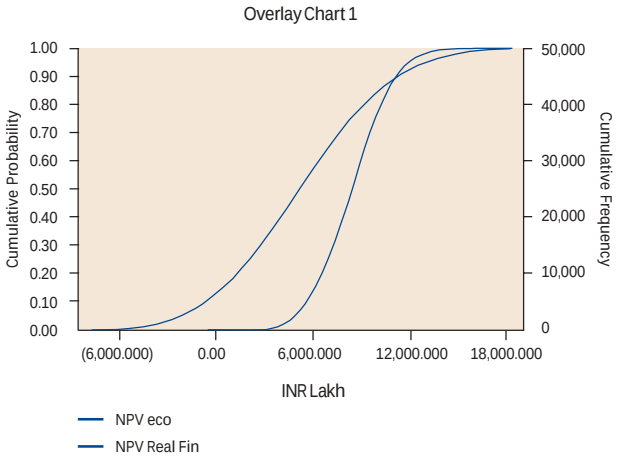
Normal distribution with parameters:

Mean	800
Std. Dev.	80

Risk Analysis report after getting 50000 run Monte Carlo simulations shows that:

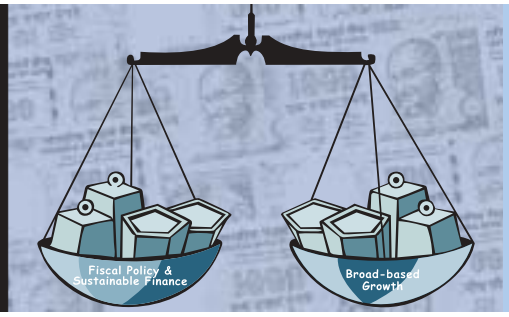
1. NPV (F): The Mean value of NPV works out to INR 84.85 lakhs, the Standard deviation INR 21.65 lakhs, the Coeff. of Variability is 0.2552. The Probability of Negative Return is 0 percent.
2. NPV (E): The Mean value of NPV works out to INR 52.90 lakhs, the Standard deviation INR 46.77 lakhs, the Coeff. of Variability is 0.8841. The Probability of Negative Return is 12.83 percent.

The overlay chart for the cumulative frequency distributions of NPV (F) and NPV (E) is given below:



Recommendations

This project is financially as well as economically viable. Therefore, it should be taken up for implementation.



Biomedical Waste Management

Guidelines for Medical Waste Management Project

The Government of Uttarakhand has notified the "Biomedical Waste (Management and Handling) Rules 1998" that apply to all persons who generate, collect, receive, store, transport, treat, dispose or handle biomedical waste in any form. To comply with these Rules in Uttarakhand, two regions namely Kumaun and Garhwal have been identified, where biomedical waste (BMW) can be treated in separate common waste treatment facilities.

In the Garhwal region, a project for common biomedical waste treatment facility (CBWTF) for waste collection, transportation, treatment and disposal has been proposed. Around 178 health care facilities generate biomedical waste in the region. So this new facility will collect, transport, treat and dispose the biomedical waste from all the 178 health care facilities (HCF). The beneficiaries of the project are the owners of health care facilities, the general public and operator of common waste treatment facility.

The BMW generated in different health care facility will be segregated in three types of waste:

1. Incinerable, in which tissues, organs and body parts etc. will be kept for incineration;
2. The waste that can be treated by chemical means and that can be shredded i.e. plastic and metallic waste; and
3. The waste that needs land filling i.e. discarded medicines, chemicals and incineration ash.

Financial Analysis

The financial analysis is conducted on the following assumptions:

- The waste generation per bed per day would be 0.3 kg;
- It is assumed that the waste contains 60 percent incinerable and the rest is recyclable waste, which can be sold to local market after treatment and shredding;
- The sale price of recyclable waste is taken as INR 5/kg; and
- The charges to be collected from health care facility are taken as INR 3.25 per bed per day at 100 percent occupancy. These charges are based on actual calculation of costs considering the monthly occupancy of different health care facilities in the Garhwal region.

This project has all the characteristics of a private enterprise including the fact that the health units generating the medical waste would be paying charges to the project at the market rate. The project is viable and the financial Net Present Value (NPV) comes to be positive. Therefore, the project would be undertaken by the private sector.

Economic Analysis

The economic analysis for this project is straightforward because market prices are being used for all the parameters and there are no controlled prices. Real economic flows are computed by adjusting the real financial cash flows using appropriate conversion factors.

The following conversion factors for the major input and output variables are computed:

- Conversion factor for cement which is a tradable goods;
- Conversion factor for steel which is again a tradable goods;
- Conversion factor for elasticity which is taken as a nontradable goods;
- Conversion factor for bricks which is taken as a nontradable goods;
- Conversion factor for civil work which has several components and is calculated as a nontraded goods; and
- Labor is assumed to receive its market price and, therefore, its conversion factor is 1.0.

Externality

The external benefit of the medical waste not polluting air, water or land will not be fully captured by the health units' willingness to pay for the services. The project is benefiting the society and environment pollution is reduced. Managing the biomedical waste in a proper manner will also reduce the probability of spreading of diseases. The actual estimation of the environmental benefits may be done by assessing the damage that the BMW might cause if it is not properly collected and disposed of and becomes the source of further infection and spread of diseases. In this exercise, environmental benefits are taken as 10 percent of the economic benefit.

The economic net present value at the social discount rate of 12 percent comes to INR 68.16 lakhs. The economic net present value is much higher than the financial net present value. This is mainly because the conversion factors for the costs are mostly less than one and because of the external benefits of the project.

Private Public Partnership (PPP)

This is a good example of private public partnership where the waste generated by the public sector is being collected by a private entrepreneur. The full elements of PPP are missing from the case because the entrepreneur has not asked for any concessions from the state government. The reason for this is because he is able to charge the market price his services rather than government determined controlled prices.

Biomedical Waste Management Project

Introduction

The Government has notified the Biomedical Waste (Management and Handling) Rules 1998 in exercise of the power conferred by section 5, 8 and 25 of the Environment (Protection) Act 1986. These rules apply to all persons who generate, collect, receive, store, transport, treat, dispose or handle biomedical waste in any form. All biomedical waste generating, handling, transport or treatment and disposal facility has to obtain Authorization from the prescribed authority. To comply with these Rules, in Uttaranchal, two regions namely Kumaun and Garhwal have been identified, where biomedical waste (BMW) can be treated in separate common waste treatment facility. In the Garhwal region, a project for common waste collection, transportation, treatment and disposal facility has been proposed. Around 178 health care facilities generate biomedical waste in the region. It is difficult and financially non viable to handle and treat BMW by individual health care facilities, besides generating a health hazard to the society. It was, therefore, proposed to develop a common biomedical waste treatment facility (CBWTF) for collection, transportation, treatment and disposal of biomedical waste as defined in the Rules.

Project Description

The main purpose of the project is to collect, transport, treat and dispose the biomedical waste from 178 health care facilities (HCF) with the total capacity of 3028 beds in the Garhwal region so that BMW Rules may be complied by these health care facilities and health of the people may be improved and environment protection ensured.

The beneficiaries of the project are the owners of health care facilities, the general public and operator of common waste treatment facility. The project will be located in district Haridwar and cover a distance of 150 km all around. The land area required will be around one acre.

The BMW generated in different health care facility will be segregated in three types of waste i.e. incinerable, in which tissues, organs and body parts etc. will be kept for incineration, the waste that can be treated by chemical means and to be shredded i.e. plastic and metallic waste, lastly the waste that needs land filling i.e., discarded medicines, chemicals and incineration ash. These waste materials will be properly segregated and placed in separate medicated plastic bags. Four color types of plastic bags will be used as per guideline i.e., Yellow for incinerable waste, Red for plastic waste, Blue for sharps and needle and Black for noninfected waste.

In this project, for disposal of above type of BMW, machinery required are incinerator, autoclave, shredder & D.G. set. Four vehicles are required for Collection of BMW in whole Garhwal region.

Capital Cost of the Project

Total investment in the project will be INR 53.47 lakhs as follows:

Operating Cost of the Project: The operating cost for the base year works out to be INR 28.5 lac/annum. Salary component will be INR 15 lakhs per year. Real wages are expected to grow with the productivity of labor, which is assumed to increase at the rate of 2 percent per annum. Electricity charges are expected to be INR 1.5 lakhs every year. For the operation of the

Table 40: Project Investment Cost Breakdown

	(INR in lakhs)
	53.47
Land and Site Development	3
Building	5
Office Equipment	1
Plant and Machinery	44.47
Incinerator	16.47
Shredder	2
Autoclave	2
Thermoclave	2
E.T.P.	4
A.P.C.S.	5
D.G. Set	1
Vehicle	12

incinerator, D G sets and vehicles, 40000 liters of fuel equivalent will be used. The average fuel price is INR 30 per liter and real growth in fuel price is projected to be 1 percent.

Waste Generation: The waste generation per bed per day is taken as 0.3 kg on actual basis. It is assumed that the waste contains 60 percent incinerable and rest recyclable waste, which can be sold to local market after treatment and shredding.

Sale Price: The sale price of recyclable waste is taken as INR 5/kg.

Waste Collection Charges: The charges to be collected from health care facility are taken as INR 3.25 per bed per day at 100 percent occupancy. These charges are based on actual calculation considering the monthly occupancy of different healthcare facilities.

Financing of the Project: Finance will be arranged by owner's contribution and term loan from bank. The term loan will be INR 39.0 lakhs and owner's equity required will be INR 14.47 lakhs.

Terms of Borrowing: The loan from financial institution will be available at 12 percent interest rate with a grace period of one year and repayment period of 10 year.

Corporate Income Tax: The facility will be exempt from corporate tax for the first five years. However corporate tax will be levied at the rate of 25 percent for next five years and after that at the rate of 35 percent.

Project Life: The project is estimated to run for a period of 15 years.

Liquidation Value: The economic depreciation is taken at the rate of 2 percent for building and at the rate of 5 percent for other assets such as equipment and machinery for salvage value.

Depreciation for Income Tax Purposes: Land will attract a depreciation rate of 10 percent every year while other assets will depreciate at the rate of 33.33 percent year after year.

Inflation: The domestic inflation rate is assumed to be 5 percent per annum. Foreign inflation is taken to be 2 percent per annum. The prices of the output and all the inputs are expected to remain constant in real terms so that price increase will simply follow the rate of inflation. The real growth of fuel charges has been taken at 1 percent per annum.

Waste Generation: It is anticipated that 1.3 kg waste will be generated from each bed/day. However, as of now, only an average of 0.3 kg waste is being generated from each bed/day. Total waste generation will increase with

increase in population for which growth rate is taken as 2 percent per annum.

Working Capital: Assumptions are: account receivable 8.33 percent of the total revenue, account payable 8.33 percent of the operating cost and cash balance 7.5 percent of the operating cost.

Discount Rate: The discount rate for the investment is assumed to be 15 percent.

Other assumptions are given in the table of parameters.

Financial Analysis

The financial analysis is conducted both from the total investment and the equity points of view. The analysis of the project from the total investment point of view looks at the overall financial feasibility of the project. Unlike the equity point of view, it does not include the loan and loan repayments as cash inflows and cash outflows respectively. The net present value from the total investment point of view and from the equity point of view is INR 27.36 lakhs.

The cash flow statement from the equity holder's point of view is first developed in nominal terms in order to take into account the effects of inflation. The nominal net cash flows are discounted by the nominal cost of capital at 15 percent to get the net present value of INR 27.36 lakhs The cash flows are then deflated to arrive at their real values; The real net cash flows are discounted by the real cost of capital at 9.52 percent to get the net present value of INR 27.36 lakhs. The cash flow profile from the total investment point of view is obtained in nominal terms in order to take into account the effect of inflation. The cash flow are then deflated to arrive at their real values. The real return on total investment perspective is taken at 8.34 percent and is used as the discount rate. The nominal rate of discount for total investment perspective has been taken as 13.76 percent. The NPV from total investment perspective also works out to INR 27.36 lakhs (nominal as well as real).

As per Financial point of view NPV of the Project is positive (INR 27.36 lakhs) and the Economic NPV is also positive (INR 68.18 lakhs) which indicates that society is benefited by the project. In the Risk Analysis the probability of negative return for financial analysis is 25 percent and it is only 5 percent for economic analysis. Therefore, we may conclude that this project is not a risky project and should be implemented.

The cash flow profile of the project from the total investment and equity points of view are analyzed. The project is profitable as shown by the positive net present value.

Sensitivity Analysis

Sensitivity analysis was performed to find out the critical variables of the project. The variables tested are waste collection charges, number of beds and operation cost.

- Waste Collection Charges: The net present value of the project is negative at waste collection charges INR 2.75 per bed per day. The net present value comes to be zero at collection charges of INR 2.92/bed/day. However, the NPV becomes positive as collection charges increase above this value and in project it is taken as INR 3.25 per bed per day.
- Number of Beds: The net present value of the project is zero at the number of beds of 2636.

In base case, we have taken the number of beds as 3028 and the NPV is positive.

- Operation Cost: The net present value of the project is positive at operation cost INR 28.5 lakhs per annum. It becomes zero at INR 31.68 lakhs and above it shows a negative NPV.

In a similar fashion, the sensitivity analysis shows a zero NPV at:

- Sale price of recyclable waste of INR 2.21/kg (Base Case INR 5.00/kg);
- Real growth of fuel charges of 5 percent (Base Case 1 percent);
- Real growth of wages of 5.2 percent (Base Case 2 percent);
- Cost overrun of 57.8 percent (Base Case 0 percent); and
- Accounts receivable of 63.7 percent (Base Case 8.33 percent).

Economic Analysis

Real economic flows are computed by adjusting the real financial cash flows from the total investment point of view using appropriate conversion factors. Both the financial and economic analyses are expressed in domestic price. This allows the distributional impacts of the project to be estimated, by subtracting the financial values of inputs and outputs from the corresponding economic values.

Estimation of Conversion Factor

The conversion factors for the major input and output variables were computed as follows:

- Conversion Factor for Input: The CIF price of Cement is computed by domestic price of cement minus transportation charges and taxes. Assuming 70 percent tradable with 12.5 percent foreign exchange premium, the conversion factor for cement is estimated as 0.95225. Similarly for steel, conversion factor works out to be 0.89938. Taking elasticity of demand as 1.0 and elasticity of supply as 3.0, the conversion factor for brick is computed as 0.96. Labor is assumed to receive its market price and, therefore its conversion factor is 1.0. Assuming 25 percent contribution of each component the overall conversion factor for civil work is calculated as 0.95.
- Investment Cost: The investment cost is given for different items. All the items contain domestic components. The economic cost of all domestic components is determined by multiplying the financial cost by the appropriate conversion factor.
- Operating Cost: Operating cost includes salary, income tax, fuel, trade tax, transport and electricity. The conversion factor for each item is computed.
- Working Capital: The conversion factor for account receivable is taken as 1.0. The conversion factor for account payable is taken as 0.96, which is same as computed for operating cost.

Project's will have an economic net present value of 68.16 lakhs. The economic net present value is much higher than the financial net present value. The project is benefiting society and environment pollution is reduced. Managing

the biomedical waste in a proper manner will also reduce the probability for spread of disease.

Distributive (Stakeholders) Analysis

The difference between the each line item of economic and financial cash flow and taking externality as 10 percent of net sale, the distributive analysis is calculated as given in Table-7. The NPV distributive is calculated as INR 55.38 lakhs. The analysis shows that NPV distributive is high as managing the BMW in proper manner benefits society.

The summarized distributive analysis is given below:

Risk Analysis

Risk analysis using the Monte Carlo simulation technique, is applied to observe how the financial and economic NPVs of the project respond to possible variation in the values of the critical variables. The quantity of waste generation, growth rate, compliance factor, growth rate of real wages, real growth in fuel price and sale price of recyclable waste are taken as critical variable. The probability distributions are applied for various assumptions and 1,00,000 simulation runs were given. Crystal Ball reports are generated and enclosed at Annexure-II. Following assumptions have been taken for doing the Risk Analysis:

Assumption: Account Receivable

Normal distribution with parameters:

Mean	8.33%
Std. Dev.	0.83%

Assumption: Accounts Payable

Normal distribution with parameters:

Mean	8.33%
Std. Dev.	0.83%

Table 41: Summary of Distributive Results

(INR in lakhs)

	Economy	Project	Others
Net Sale	0.00		
Change in Account receivable	0.00		
Externality	32.73		
Salvage Value		0.08	
Investment cost			
Plant and Machinery and Vehicle		4.44	
Land and Building		0.40	
Office Equipment.		0.10	
Preoperative Exp.		0.00	
Operating Cost		10.41	
Maintenance Cost		0.12	
Change in Account Payable			0.13
Change in IMPREST Account		0.12	
Income Tax	7.10		
Total	**39.83**	**15.67**	**0.13**

Assumption: Actual Waste Generation/Day per Bed

Normal distribution with parameters:

Mean	0.30
Std. Dev.	0.03

Assumption: Cost Overrun

Triangular distribution with parameters:

Minimum	0%
Likeliest	0%
Maximum	20%

Assumption: Electricity Charges

Normal distribution with parameters:

Mean	1.50
Std. Dev.	0.15

Assumption: Cash Balance

Normal distribution with parameters:

Mean	7.50%
Std. Dev.	0.75%

Assumption: Number of Beds

Normal distribution with parameters:

Mean	3,028.00
Std. Dev.	302.80

Assumption: Real Growth in Fuel Charges

Normal distribution with parameters:

Mean	1.00%
Std. Dev.	0.25%

Assumption: Real Growth in Wages

Normal distribution with parameters:

Mean	2.00%
Std. Dev.	0.50%

Assumption: Sale Price of Recyclable Waste

Normal distribution with parameters:

Mean	5
Std. Dev.	1

Assumption: Waste Collection Charges

Normal distribution with parameters:

Mean	3.25
Std. Dev.	0.33

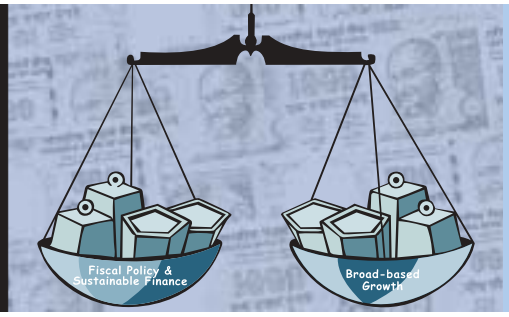
Conclusions

As per Financial point of view NPV of the Project is positive (INR 27.36 lakhs) and the Economic NPV is also positive (INR 68.18 lakhs) which indicates that society is benefited by the project. In the Risk Analysis the probability of negative return for financial analysis is 25 percent and it is only 5 percent for economic analysis. Therefore, we may conclude that this project is not a risky project and should be implemented.

Recommendations

Disposal of Biomedical waste is the need of the hour for health and hygiene of the society. Therefore, the Government should strictly enforce the provision of BMW Management Rules. If all healthcare facilities are linked to the common waste treatment facility, by the economies of the scale, the rates can be reduced and at the same time society will be benefited as the risk of communicable diseases will be minimized.

Government should also engage itself in the IEC activities to make the public aware about the importance of the management of Biomedical waste.



Education and Health Sectors

Guidelines for Social Sector Projects: Education and Health Projects

Introduction

The successful implementation of good education and health projects contributes to the development of human capital. Compared to projects in other sectors, such as water and roads, it may be more difficult to measure the benefits for these projects. The economic benefits of education vary across primary, secondary and tertiary education. Similarly, the economic benefits of a health project depend on the nature of the health intervention.

For projects in the education and health sectors, the financial NPV (Net Present Value) will be negative if there is no cost recovery. Even with cost recovery, only a small proportion of the costs are recovered. However, with project appraisal, one must ensure that the economic NPV is positive.

Main Economic Benefits of Education and Health Projects

Education and health projects provide the following economic benefits:

- Increase in labor productivity;
- Improvement in the quality of life; and
- Other positive externalities.

Measuring the Economic Benefits of an Education Project

In principle, we should be able to estimate a demand curve for the services provided by an education project. The demand curve measures the willingness to pay. For tertiary (or higher) education, it is easy to measure the economic benefits because we can observe the wage differentials in the labor markets. For example, we can estimate the average wage for a person with tertiary education compared to a person with only a secondary education. Thus, if the education project is going to provide tertiary education, then the differential wage is a good approximation of the economic benefits.

Similarly, for a secondary education project, we estimate the average wage for a person with secondary education compared to a person with only a primary education, and for a primary education project, we estimate the average wage for a person with primary education compared to a person with no schooling.

The measurement of the economic benefits of an education project depends critically on the availability of labor market information over several years. In some cases, it may be difficult to obtain time-series data on wage differentials. One way to overcome the data availability problem is to conduct extensive sensitivity and risk analysis, using different assumptions for the future profile of the wage differentials.

In addition to education projects that are in the formal sector, some education projects may be in the informal sector. For example, there may be adult education programs that promote literacy or education programs that cater to persons who are no longer in the school-going age groups. Unlike projects in the formal sector, it may be much more difficult to estimate the benefits of education projects in the informal sector. Nevertheless, it is important to think about the potential benefits and a rough estimate of the benefits is better than no estimate at all.

In the above discussion on the measurement of the economic benefits of education projects, we have emphasized the labor market performance of the participants or beneficiaries of the project. The labor market performance is the best objective measure of the economic benefits. However, in many cases, the information on the labor market performance may not be available, and even when the information is available, it may be incomplete or it may not capture some of the other important benefits that the project may generate.

As mentioned earlier, we may impute some premium to the project for increasing the number of persons who are receiving educational services. However, if after this adjustment for the positive externality, the NPV of the project is still negative, then the project should be rejected and alternative project proposals for providing educational services should be explored.

Measuring the Economic Benefits of a Health Project

Measuring the economic benefits of a health project may be more difficult than measuring the economic benefits of an education project. The provision of health services can reduce the morbidity and mortality rates in an area. The valuation of the reduction in the morbidity rates can be estimated by valuing the wages that the participants could earn in the labor market.

The reduction in mortality is more problematic and controversial. In the case of mortality one has to specify the value of a human life, and many decision makers do not wish to do so. At the same time, one has to recognize that the value of a human life is not infinite or priceless.

For example, consider a road project. In the construction of a road or highway, there is always the risk that there will be fatalities, even if the best safety precautions are taken. It would be prohibitively expensive to build roads with the condition that no fatalities occur.

Similarly, in health projects, we have to recognize that we have to impute the value of a life to the reduction in mortality that is an outcome of a health project. If the value of life were sufficiently high, then all health projects would be approved, regardless of the cost. On the other hand, if the value of life were sufficiently low, then no health project would be approved.

Positive Externalities for Education and Health Projects

There is empirical evidence that education and health projects generate positive externalities, and in the assessment of the economic benefits, we must take these positive externalities into account. For example, improving the literacy of mothers allows the mothers to take better care of the health and nutrition of their children. Farmers with improved literacy are productive in farming. Improving the health of the citizens enhances the life of the communities in which they live.

Cost-effectiveness in Social Sector Projects

In many social sector projects, it is difficult to estimate the monetary value of the economic benefits, and consequently, one cannot compare the economic benefits with the economic costs.

For example, in a primary education project, there may be different approaches for educating the children. We may have information on the number of school children who participate in the project. However, there may be little or no information on the wages that the children may be able to earn after the completion of the schooling. The economic costs for each of the different approaches may be available. For each of the different approaches, we can calculate the cost for educating one child and compare the cost-effectiveness. Since we are unable to estimate the benefits, we use the number of children as the unit of analysis. We assume that the economic benefits from the different approaches are similar, and choose the approach that is most cost-effective in providing educational services per person.

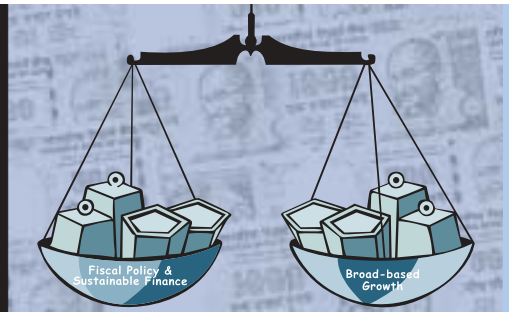
Similarly, in health projects, one can compare the costs for vaccinating one child for different interventions and select the intervention that has the lowest cost.

Basic Needs Premium

In health and education projects, equity considerations have to be explicitly incorporated into the framework by imputing premiums to the projects for increasing the provision of basic needs in education and health. These are the cases where the projects invariably have an element of catering to basic needs and therefore, the economic benefits need to be suitably augmented.

Conclusion

The basic principles of project appraisal are relevant for social sector projects. However, in social sector projects, it is more difficult to measure the benefits, and there is greater uncertainty about the benefits. Thus, risk analysis can provide guidance about the financial and economic viability of the investment projects.



Annexure 9

Towards Improving Project Appraisal Management at the Indian State Level:

Case Studies of Jharkhand, Karnataka and Uttarakhand

Chapter 1: Overview

The following sections provide a comparative account of how the REFORM Project state teams in Jharkhand, Karnataka, and Uttarakhand implemented their various project appraisal reform activities. These accounts discuss the implementation methodology, work plan execution, operational challenges and how these were dealt with, and the results of this work. Finally, and importantly, these state team accounts have been approved by each respective state government counterpart for use in this compendium.

REFORM Project focus on Project Appraisal was in response to partner government requests to help them modernize and improve the nature of their previous project appraisal processes. Essentially, they saw a need to conduct more rigorous and comprehensive project appraisals including the financial, economic, social and stakeholder impact of their projects. This was necessitated by their recognition that many of the large capital projects they had invested in were not providing the economic or financial returns originally projected and, in some cases, were a drain on public expenditures. This preexisting gap between project appraisal requirements and project selection and funding led to a number of negative consequences in the expenditure practices. Namely:

- Continued reliance on *ad hoc* executive decisions on capital expenditure resulted in poorly defined project scope and cost planning such as the Tehri Dam Project which took 20 years longer than planned due to chronic underfunding of the project;
- Projects fail to meet their objectives. For instance, the ENRON power project in Maharashtra failed for a variety of reasons including unrealistic objectives due to poor initial appraisal;
- Projects cause serious political tumult as the local community and other project stakeholders were not properly considered during the appraisal process (*e.g.*, the Narada Dam Project.);
- New project proposals submitted without any financial, economic or stakeholder analysis.
- New projects or project revisions not subjected to appraisal by the Planning Department;
- Administrative departments and the Planning Department do not have the capacity and the skill to conduct project analysis; and
- Sporadic monitoring, evaluation or impact analysis done at the completion of a project or program.

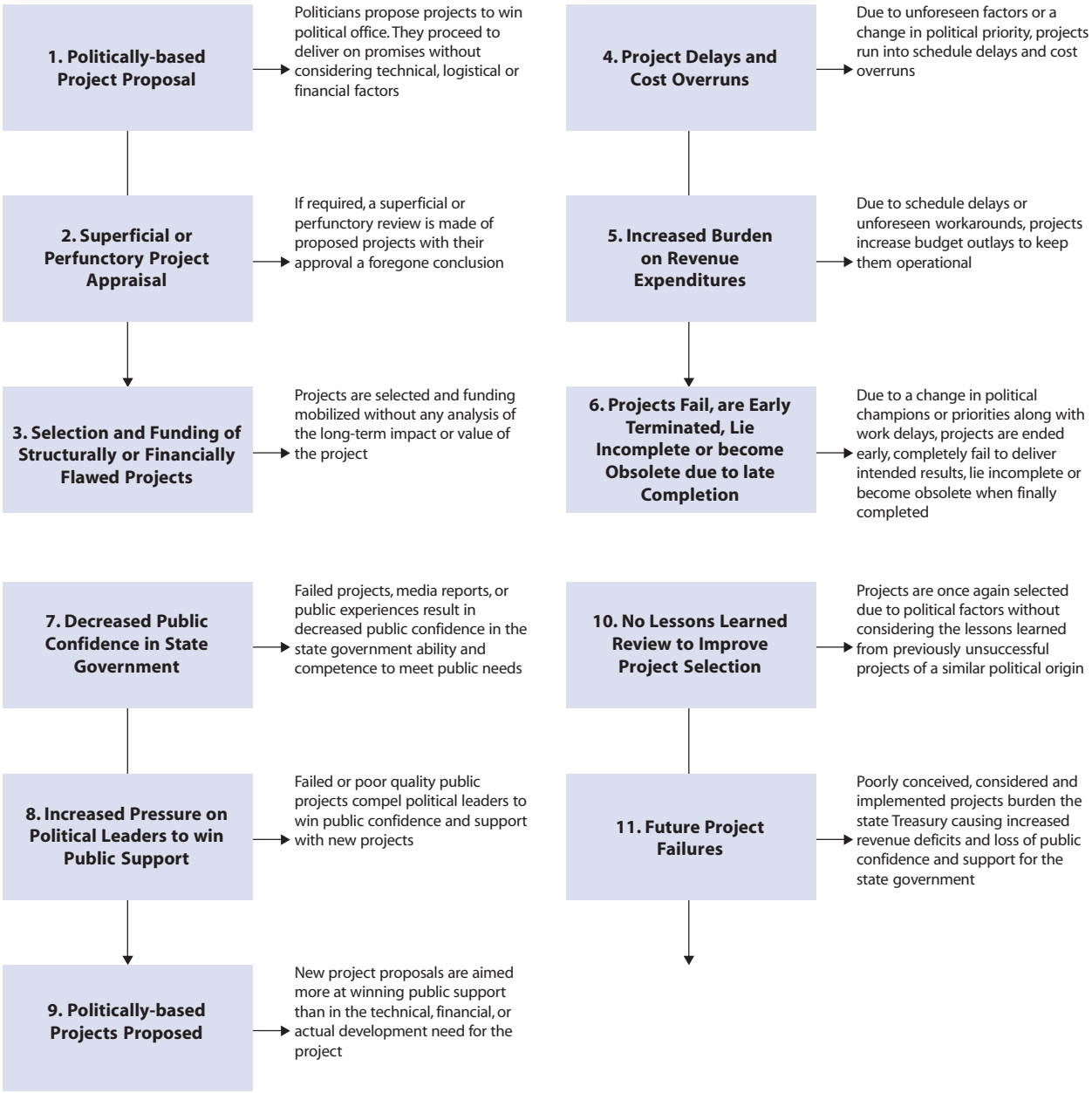
The following process maps depict the ***vicious*** project appraisal processes that typically afflict state governments and the ***virtuous*** project appraisal process promoted by the REFORM Project.

Thus, the objectives of the Project Appraisal Management work of the REFORM Project were designed to:

- Develop a cadre of state officials trained in modern project appraisal techniques (quantitative and qualitative);
- Introduce an "international best practice" Project Appraisal manual to serve as a desk reference for all officials responsible for project selection; and

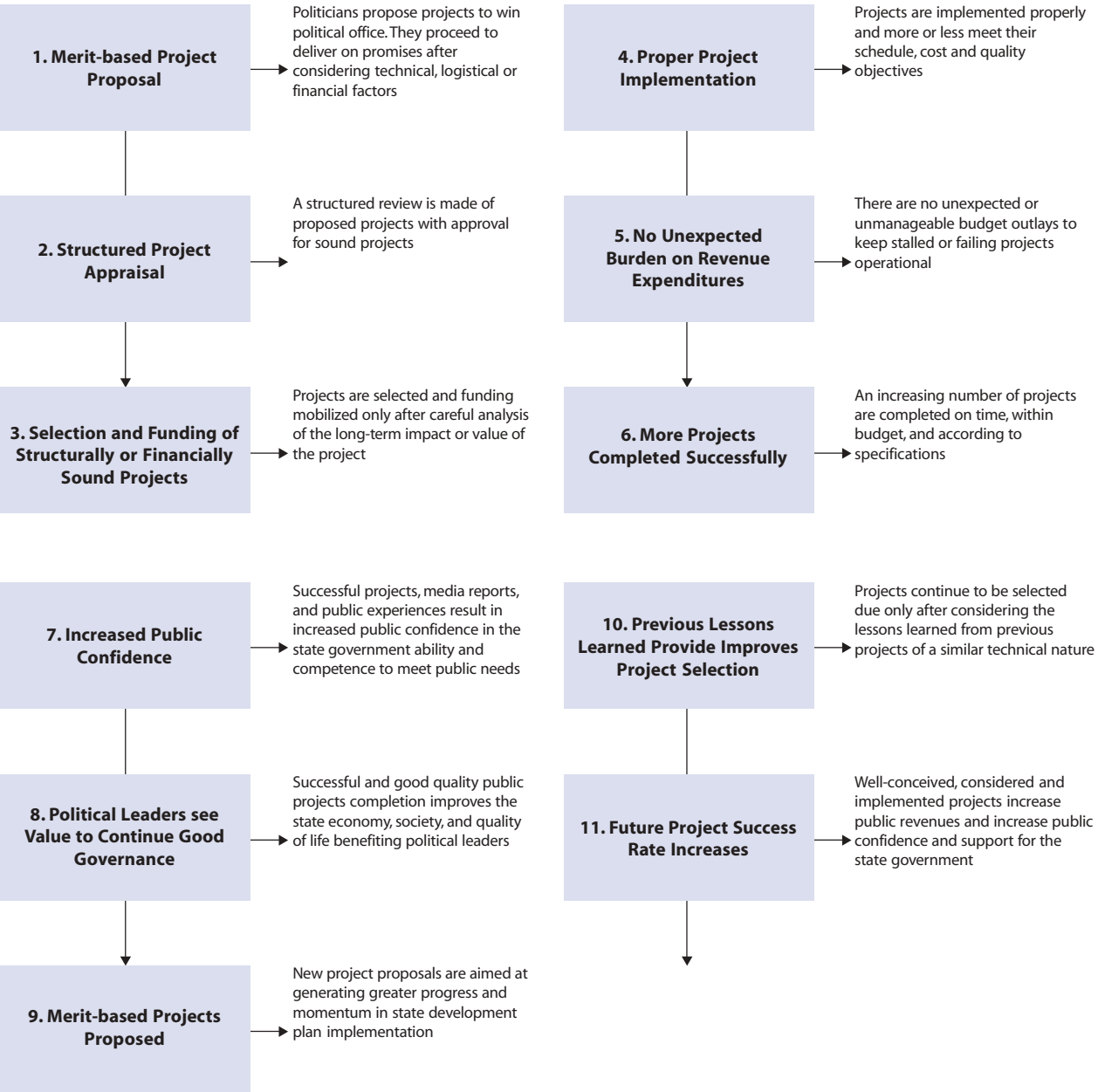
[1] Harberger, Arnold C., "Techniques of Project Appraisal; University of Chicago; 1972.

Figure 1.1: Vicious Project Appraisal Process



Note : Vicious process refers to a situation where a series of actions leads to increasingly negative results

Figure 1.2: Virtuous Project Appraisal Process



Note : Virtuous process refers to a situation where a series of actions leads to increasingly positive results

- Develop a center of excellence for project management (PMU) that will also look at Public-Private Partnership (PPP) potentials for projects under review.

To this end, the project offered a complete set of expertise covering all phases of project appraisal management to close the gaps present in the partner states. The project appraisal work was implemented by the Duke Centre for International Development (DCID), which is a part of Duke University. The DCID project appraisal intervention was based on the Professor Arnold Harberger as articulated in his paper "Techniques of Project Appraisal".[1] The Harberger project appraisal approach emphasizes these key factors when appraising projects. Namely, the:

- Necessity of decentralized decision-making;
- Inclusion of relatively small-scale projects to regular appraisals before their launch; and
- Attention on the effects of uncertainty (imperfect foresight) of information which most appraisal treats the information as though it were known with certainty; and
- Changes in discount rates and input prices and how these affect the expected benefits or net present value of the proposed project.

Specifically, the project planned and executed:

- Capacity-building programs in project appraisal techniques;
- Training in the use of the *Crystal Ball* risk analysis software;
- Advise in preparing Government Orders (GO) to require a rigorous project appraisal process for all projects above a certain threshold;
- Preparation of the terms of reference and operational protocol for a Project Formulation and Appraisal Division (PFAD) in the planning department to serve as the state Project Unit (PU); and
- Practical "hands-on" mentoring of state officials engaged in the appraisal of capital projects for submission to the Government of India for funding.

REFORM Project Initiatives, Impact and Leveraging

Government	Achievement	Impact	Leveraging
Jharkhand	• A core group of officers have been created to carry on the work of project appraisal in the GoJ • This core group has been trained in the use of risk management software (e.g , *Crystal Ball*) to facilitate their appraisal of project proposals	• Members of this core group are imparting training at the workshops being organized at the state SKIPA and SIRD as part of their annual training calendar	• Both SKIPA and SIRD have allocated budget funds for their annual Project Appraisal course offerings

Government	Achievement	Impact	Leveraging
Karnataka	• A core group of officers have been created to carry on the work of project appraisal in the GoK • This core group has been trained in the use of risk management software (e.g., *Crystal Ball*) to facilitate their appraisal of project proposals	Will work in the PFAD in the Planning Department to supervise mandatory appraisal for all projects costing more than INR 100 million in infrastructure and INR 20 million in social sector projects	Prospective Planning Department regular budget funding for the PFAD
Uttarakhand	GoU issued a budget order in June 2007 mandating and codifying use of the REFORM Project-imparted project appraisal process for all projects more than Indian Rupees (INR) 50 million	Based on this order, a total of 35 projects were appraised out of which 11 were rejected as being either economically or financially unviable. Specifically: • A total of 27 project proposals were appraised, 24 revised, and three rejected before submission to the *National Bank for Agriculture and Rural Development (NABARD)*; and • A total of eight irrigation proposals were rejected before submission to the GoU *Expenditure Finance Committee (EFC)*	To be determined
Government of India	The Duke University Team is training Phase III Indian Administrative Service (IAS) officers at the *Lal Bahadur Shasthri—National Academy of Administration (LBS-NAA)* in Mussoorie	All Phase III IAS officers at the LBS-NAA will be trained in the project appraisal techniques provided by the REFORM Project	Use of GoI funds to fund the training of Phase III IAS officers
	Introductory lectures on project appraisal techniques held at the *Comptroller and Auditor General—National Academy of Audit and Accounts (CAG-NAAA)* in Shimla	All CAG officers at the *CAG-NAAA* will be trained in project appraisal techniques provided by the REFORM Project	Use of GoI funds to fund the training of CAG officers in project appraisal techniques

Finally, the REFORM team has learned the following key lessons that can be leveraged by other state governments interested in introducing new expenditure management tools and techniques:

- In order to generate synergies between the two key state government departments involved in project appraisal, strong and coordinated support from both the Principal Finance Secretary and Principal Planning Secretary is essential to ensure all projects submitted to the Finance Department have been properly appraised before hand by the Planning Department;
- To facilitate institutionalization of modern project appraisal techniques, the use of existing project units (*e.g.*, program support units, expenditure finance committee (EFC)) is strongly advised as creating new structures is time-consuming, politically-charged and prone to delay and failure;
- Government Orders (GO) requiring the use of a structured project appraisal process that considers all risk dimensions of a project (*e.g.*, stakeholders, cash flow, logistical, financial) ensures that departmental budget officers are aware this appraisal approach and their obligation to undertake the same;
- Appointment of dedicated project appraisal team members creates cohesion and continuity in team membership thereby enabling the consistent and disciplined level of effort needed to properly appraise proposed projects;
- To ensure complete skill transferal, all capacity-building programs need to start and finish within twelve (12) months in order to avoid high trainee attrition rates that reduces the number of properly trained project appraisers;
- The early identification, training, and utilization of government program and project appraisal officers to serve as trainers and change agents greatly facilitates the extension and sustained implementation of modern project appraisal techniques; and
- Periodic press coverage of the project appraisal management efforts of the state government help to engender public and political interest in these reform efforts that, in turn, reinforces and compels the state government to continue down the reform path.

Box 1.1

I attended the first stage of the training conducted by USAID & Gok on "Project Appraisal." It was indeed apt that the training started with practical sessions involving case studies through project appraisal analytical tools. The essence of the exercise was to find out whether the project under question was worth pursuing vis-a-vis other alternative projects. In this direction, the financial analysis was to compare the cash inflow and cash outflow on NPV basis adjusted to inflation indices, to arrive at the net gain of the project.

After the training, as GM (F&A), RGRHCL, I was able to put the financial analysis to the advantage of the Company resulting in a saving of INR 18,28,882 for the quarter January to March 2005. This is explained below:

The Company's outstanding loan in respect of major FIs, as on 01.01.2005 was of the order of INR 41648.12 lakhs and the quarterly repayment was of the order of INR 2321.61 lakhs comprising INR 1268.25 lakhs as principal and INR 1053.36 lakhs as interest. The quarterly repayment details as on 01.01.2005 was as follows:

(INR In Lakhs)

Institution	**Repayment**			**Rate of Interest**
	Principal	**Interest**	**Total**	
HUDCO	854.55	747.07	1601.62	7.5% and 8%
Corporation Bank	89 30	97.07	186.37	8%
Union Bank of India	127.97	93.46	221.43	7 5%
Indian Bank	8.93	9.27	18.19	7 5%
Oriental Bank of Commerce	187 50	106.49	293.99	7.25%
TOTAL	**1268.25**	**1053.36**	**2321.6**	

What we thought was that we can take short-term loan at a lower rate of interest, because short-term loans are available at lower rate of interest, and prepay partially to the FIs. In order to save the interest difference, the analysis for this purpose was made using the financial tool explained to us in the training and one important aspect that the tool threw out was that we should not prepay interest but we should only prepay principal. The analysis made in respect of one such loan is enclosed at Annexure A, wherein we were able to save INR 11,61,741 due to interest difference. This was done by obtaining a 90 days short-term loan of INR 25 crores from Karnataka Bank, at an interest rate of 5.75 percent, which was utilized for prepaying principal in respect of loans having interest rate ranging 7.25 percent to 8 percent.

In all, by such an exercise, we were able to save INR 18,28,882 for the quarter January—March 2005.

Anil B Shedbal
Company Secretary and General Manager (F&A)

Chapter 2: Implementation Experiences

State governments do not have ability to conduct rigorous project appraisals that review the financial, economic, social and stakeholder impact of their projects. They also lack a clear process for capital programming and budgeting that adversely returns on public investments.

In general, Indian state governments do not have adequate ability to conduct rigorous project appraisals that review the financial, economic, and social and stakeholder impact of their projects. They also lack a clear process for capital programming and budgeting that adversely affects returns on public investments. Consequently, project selection is based on *ad hoc* executive decisions on how to allocate capital expenditure. This *ad hoc* process has resulted in poorly defined project scope and cost planning such as the *Swarna Rekha Project* which has been delayed by more than three decades due to chronic underfunding of the project. In addition, projects fail to meet their objectives. For instance, the ENRON power project in Maharashtra failed for a variety of reasons including unrealistic objectives due to poor initial appraisal. Finally, approved projects have often caused serious political tumult as the local community and other project stakeholders were not properly considered during the appraisal process (*e.g.*, the Narmada Dam Project).

The Challenge

Jharkhand

When it became a new state on November 15, 2000, (created out of Bihar) the Government of Jharkhand (GoJ) did not have adequate ability to conduct rigorous project appraisals that review the financial, economic, social and stakeholder impact of their projects. They also lacked a clear process for capital programming and budgeting that adversely affects returns on public investments.

Starting in 2004, upon the request of the GoJ, the USAID-funded India State Fiscal Management Reform Project (REFORM) has worked to:

- Develop a cadre of state officials trained in modern project appraisal techniques (quantitative and qualitative); and
- Introduce an "international best practice" Project Appraisal manual to serve as a desk reference for all officials responsible for project selection.

At its inception, the GoJ had established an Empowered Committee (EC) but for projects being put up before it for approval, only the Benefit: Cost Ratio was calculated and that, too, was not done in a consistent, systematic or standardized manner for all projects. Annual Cash flow analyses were missing and thus potential liquidity issues during the project operational phase could not be foreseen and planned for. This resulted in a heavy financial burden on the state treasury due to the scarce resources of the GoJ. Subsequently, the EC has also been done away with. Under the present dispensation, projects up to INR 50 million are approved by the department itself and projects exceeding that amount have to be cleared by the Cabinet. The system of appraisal of the projects remains the same.

Karnataka

Though planning in Karnataka started since formation of the state, in recent times, project preparation and appraisal has not received adequate attention. Feasibility reports are appraised generally and lack in adequate appraisal, with the result that substantial cost and time overruns became a common feature of

public sector projects. The Government of Karnataka (GoK) did not have adequate ability to conduct rigorous project appraisals that review the financial, economic, social and stakeholder impact of their projects.

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- Introduce an "international best practice" Project Appraisal manual to serve as a desk reference for all officials responsible for project selection.

The GoK had established a High Level Committee (HLC) but for projects being put up before it for approval, only the Benefit: Cost Ratio was calculated and that, too, was not done in a consistent, systematic or standardized manner for all projects. Annual Cash-flow analyses were missing and thus potential liquidity issues during the project operational phase could not foreseen and planned for. This resulted in a heavy financial burden on the state treasury due to the scarce resources of the GoK.

Uttarakhand

When it became a new state on November 9, 2001, (created out of Uttar Pradesh) the Government of Uttarakhand (GoU) did not have adequate ability to conduct rigorous project appraisals that review the financial, economic, social and stakeholder impact of their projects. They also lacked a clear process for capital programming and budgeting that adversely affects returns on public investments.

Table 2.1: Project Appraisal Management Implementation Process

Inputs	1.	Proposal to introduce international best practice Project Appraisal (PA) techniques accepted by state governments
	2.	State officials selected for Project Appraisal (PA) training
	3.	Financial Analysis, Economic and Stakeholder Analysis, and Risk Management Training Completed
	4.	Capital Budgeting and Project Prioritization training completed to help states select projects based on international best practices
Outputs	1.	Sector-specific Feasibility Report template developed to help states make good project selection
	2.	PA Training Manuals developed and accepted by states
Intermediate Outcomes	1.	State government notification issued (2007-08) to institutionalize use of methodology/Manual for projects costing more than INR 50 million[2]
	2.	Establishment of a center of excellence in project management (PMU) initiated[3]
	3.	Project Appraisal in use? (Impact?)

[2] At least 33 percent of all projects above INR 50 mn to use the PA technique in their selection in 2007-08.
[3] To provide expertise and best practices in project management including PPP models and database on ongoing large projects in India, among others.

Starting in 2004, upon the request of the GoU, the USAID-funded India State Fiscal Management Reform Project (REFORM) has worked to:

- Develop a cadre of state officials trained in modern project appraisal techniques (quantitative and qualitative); and
- Introduce an "international best practice" Project Appraisal manual to serve as a desk reference for all officials responsible for project selection.

At its inception, the GoU had established an Executive Finance Committee (EFC) existed but for projects being put up before it for approval, only the Benefit: Cost Ratio was calculated and that, too, was not done in a consistent, systematic or standardized manner for all projects. Annual Cash-flow analysis were missing and thus potential liquidity issues during the project operational phase could not foreseen and planned for. This resulted in a heavy financial burden on the state treasury due to the scarce resources of the GoU.

Implementation Methodology

The REFORM Project Appraisal training program began in August 2004 and was implemented by the Duke Centre for International Development (DCID) of Duke University, USA. *The first training phase* covered financial analysis and it was attended by 42 participants. This module covered various components of cash-flow analysis, compounding, discounting, alternative investment criteria, impact of inflation on investment analysis, scale, timing and cost effectiveness. After the training program, the participants were asked to select live cases for which the data was available to them. The participants were divided into 15 groups and were asked to do the financial analysis of the projects by the techniques they learnt in the training program. Then the mentoring sessions were there to facilitate the participants. After some dropouts and reorganization of groups, 10 groups completed and presented their financial analysis on December 6-7, 2004.

In *the second training phase*, Economic and Distributive Analysis was conducted in the April-May 2005 time frame. This training phase was attended by 26 participants and in this training program basic macroeconomics, principles of applied welfare economics, tradable and nontradable goods, calculation of conversion factors, economic rate of discount, foreign exchange premium and the method of converting financial cash flow to economic resource flow were discussed. The participants were mentored and again there were some dropouts and seven groups completed their economic analysis.

In *the third training phase*, instruction on "Risk Analysis and Risk Management" was conducted in September 2005 and was attended by 18 participants. A total of 7 groups completed their case studies. In this program, the basics of statistics, sensitivity analysis, scenario analysis, project finance, risk analysis, risk management and application of the risk management software *Crystal Ball* were covered.

The fourth and final phase of the training program took place in April 2006 with a program on "Integration of Project Appraisal with Capital Budgeting and Writing Sector-specific Manual." This course was attended by 20 participants. In this program, integration of project appraisal with capital budgeting was discussed. Participants were also guided on the process of writing the manual.

Finally, as a result of this comprehensive training course, the participating government officials are able to work on *MS Excel, MS Word* and *MS PowerPoint*—software applications they had not previously been able to use.

Subsequently, a second round of training was conducted for the officers of GoJ. Instead of four phases, it was conducted by the DCID team in two phases in a compressed form. The first phase was conducted in February 2007 and it was attended by 43 participants. In this program, Financial Analysis and an introduction to Economic Analysis was covered. The second phase was held in April 2007 and was attended by 31 participants. In this phase, Economic, Stakeholders and Risk Analysis were covered.

Implementation Challenges

The implementation of the above project appraisal process was not without its challenges and constraints. Each state team experienced resistance or obstacles in terms of partner state receptivity and assistance. The following accounts describe the experiences of each state team as they faced these challenges. These experiences also provide an account of how and how successful the challenges were managed.

State Experiences

Due to the common expert team from DCID and the uniform implementation approach in all states, there was no resistance as such to the during the project appraisal capacity-building phases. However, the initial trainee cohort was comprised of partner government officials who were not necessarily the most appropriate—due to their lack of daily involvement in actual project appraisal—for the training.

This gap between the official profile of the trainee and the required profile was caused by the difficulty the REFORM Project team found in meeting with senior officers in all of its partner states. Part of the reason for this was that the officers at the execution level felt that this will add to their existing work. Thus, they were reluctant participants in the capacity-building effort. To address this resistance, the REFORM team doggedly pursued meetings at the senior levels and kept on mentoring the trained officers. The result, over time, was the acceptance of the new project appraisal tools and techniques and the active involvement of core group of officers in the institutionalization efforts.

The other key issue that affected the initial capacity-building efforts was the lack of consistent attendance at training courses by the original trainee cohort. In fact, in all three states, the final graduation rate was around 25 percent from the initial trainee pool. This low graduation rate was alleviated in the second—and final—trainee cohort with a shorter time frame for the training course series.

The other key issue that affected the initial capacity-building efforts was the lack of consistent attendance at training courses by the original trainee cohort. In fact, in all three states, the final graduation rate was around 25 percent from the initial trainee pool. This low graduation rate was alleviated in the second—and final—trainee cohort with a shorter time frame for the training course series. In the second cohort, approximately 75 percent of the original trainees actually completed the course series.

Once the training courses had been completed, a third implementation constraint was the lack of a formal government order (GO) requiring use of the DCID-imparted project appraisal process for all capital projects above INR 50 million. To date, this bottleneck to operationalizing the project appraisal process was only overcome in

Uttarakhand. Unfortunately, due to changes in the Planning Department incumbency in Jharkhand and other state government priorities in Karnataka, similar GOs have yet to be issued.

Finally, the inability of any of the partner states to establish a project unit (PU) has been the result of either incumbency changes in Jharkhand or other state priorities in the cases of Karnataka and Uttarakhand.

The REFORM Team has attempted to overcome these implementation bottlenecks through persistent correspondence to either the Chief Secretary in Jharkhand or the Principal Finance and Planning Secretaries in the cases of Karnataka and Uttarakhand. At this time, it is not clear if the required GOs requiring a structured project appraisal process executed by the PU (i.e., PFAD) will be possible in the remaining days of the REFORM Project. However, these state government actions are listed as line items in the Unfinished Agenda section below.

Box 2.1

Quick Appraisal of NABARD-financed Projects

Dehradun, Jagran Bureau: A quick appraisal of NABARD financed projects will be made. It will be done by a committee constituted under the chairpersonship of Secretary (Planning).

In an order issued by the Principal Secretary (Finance), it has been stated that the projects financed by NABARD involve loans on which interest is to be paid. The Government has decided that before referring these proposals to NABARD, a committee under the chair person ship of Secretary (Planning) will do a quick appraisal. This committee will also have a member each from the Finance, Administrative and Technical Departments.

As per the norms prescribed by NABARD the feasibility of the projects will be ensured based upon cost of the project and profitability. It has been decided that after the project formulation it will be referred to the Appraisal Division, which in turn will get it approved by the committee and send it to the Finance Department within a week so that the projects can be sent to NABARD in time after the examination from the committee.

Translation of the news clipping of Dainik Jagran, Dehradun, dated November 14, 2007.

Box 2.2: Testimonial Letter from Uttarakhand Planning Commission

I attended the two phases of Project Appraisal Training Program in January-February and April 2007, which was conducted by REFORM Project, USAID/India. I was interested in this program as it was related to my work in the State Planning Commission. It helped me a lot in appraising projects in a more objective way.

This training program was far superior to the existing training programs available on PA in India as it was application based.

Before coming to Uttarakhand, I was doing EFC proposals in the State of UP. There I could not do economic analysis and was unable to adjudge the financial viability of the projects. In UP I, like many others in the PFA Division, just looked at the cost estimates along with other methodologies developed regarding feasibility of a particular type of project.

After the aforesaid training, I did the economic analysis of 27 proposals for submission to NABARD and pertaining to Power and Roads were reviewed. Out of these projects, three projects were found to be economically unviable and these were rejected. In addition, another eight irrigation projects that were going to be submitted to the Expenditure Finance Committee were rejected as we found that they were economically unviable. Previously, these projects may have been funded and later failed.

Lastly, this training has provided us with an advanced decision making tools in financial risk analysis to assess the financial and economic viability of the project. Had this training been provided to me earlier, I could have used it in my previous posting in UP, where there is an established division for this purpose. This training will be of great help in UP also.

I do think that two-weeks training on Project Appraisal is not sufficient in dealing with the projects that we receive for appraisal.

Devesh Kumar Sharma
Research Officer,
State Planning Commission,
Uttarakhand

Chapter 3: Implementation Results

The project appraisal achievement of the REFORM Project in its three (3) partner states—Jharkhand, Karnataka, and Uttarakhand—as well as nationally with respect to the knowledge, attitude, practices and impact construed:

Table 3.1: Project Appraisal, Knowledge, Attitudes, Practices Results

FISCAL SECTOR	Jharkhand	Karnataka	Uttarakhand	Government of India
Knowledge Transferred	• More than 70 officers trained in project appraisal. • A core group of 10 officers available as trainers/mentors. • More than 70 officers trained in *Crystal Ball* software. • A *Project Appraisal Manual* with sector-specific guidelines is being provided for GOJ reference and training. • TOR for a project formulation and appraisal division (PFAD) submitted.	• More than 100 officers trained in project appraisal.· A core group of 25 officers available as trainers/mentors. • More than 100 officers trained in *Crystal Ball* software. • A *Project Appraisal Manual* with sector-specific guidelines is being provided for GOK reference and training at FPI. • TOR for a project formulation and appraisal division (PFAD) submitted.	• More than 85 (60 secretariat and 25 district) officers have been trained in project appraisal techniques. • A core group of 18 officers available as trainers/ mentors. • More than 60 officers trained in *Crystal Ball* software. • A *Project Appraisal Manual* with sector-specific guidelines is being provided for GOU reference and training at UAA. • TOR for a project formulation and appraisal division (PFAD) submitted.	Training courses in PA for: IAS trainees at LBS-NAA; and, CAG officers at NAAA.
Attitudinal Change	Acceptance of need for a structured analysis of major capital projects has led to GOJ considering establishment of an Empowered Committee (EC) chaired by Chief Secretary/Development Commissioner to review and approve project proposals before submission to the state cabinet.	GOK considering issuance of a GO to mandate a structured project appraisal process all capital projects costing more than INR 100 million in infrastructure and INR 20 million in social sector projects, starting with fiscal year 2009-10.	Acceptance of need for a structured analysis of major capital projects has resulted in a GOU June 2007 budget order mandating use of project appraisal process for all projects more than Indian rupees (INR) 50 million.	

Table 3.1: Project Appraisal, Knowledge, Attitudes, Practices Results (Contd.)

FISCAL SECTOR	Jharkhand	Karnataka	Uttarakhand	Government of India
Practices Introduced	GOJ is using the *Project Appraisal Manual and Guidelines* as training tools at the SKIPA and SIRD.		Based on 2007 GOU GO, 35 projects were appraised of which 11 were rejected for being financially unviable. Specifically 27 project proposals were appraised, 24 revised, and 3 rejected before submission to the *National Bank for Agriculture And Rural Development (NABARD)*; and, 8 irrigation proposals were rejected before submission to the GOU Expenditure Finance Committee (EFC).	
Impact(s) Realized		The company Secretary and General Manager (F&A) of the *Rajiv Gandhi Rural Housing Corporation Ltd* was able to put the financial analysis to the advantage of the company, saving INR 18,28,882 (INR 1.8 million) for the quarter ending March 2005.	• Since November 2007, the GOU has saved about INR 5 crores through use of the REFORM project appraisal process: 3 of 27 NABARD projects along with 8 irrigation projects were rejected for being economically unviable before submission to the state EFC. • *Uttarakhand Transportation Corporation* use of risk analysis software to purchase new bus fleet using debt financing facility.	

Chapter 4: Lessons Learned

As a result of the above project appraisal interventions in all three partner states, the REFORM Project is able to provide a comprehensive list of lessons learned that can be leveraged by other state governments engaged in public expenditure reform. The lessons learned fall into two broad categories:

- Enabling factors, which assisted or facilitated the implementation, adoption, and sustained use of the tools and techniques introduced; and
- Impeding factors, which delayed or prevented the implementation, adoption, and sustained use of the tools and techniques introduced.

More specifically:

Enabling Factors

- Obtaining the early and strong and coordinated support from the Principal Finance Secretary greatly facilitated launching the capacity-building programs in each partner state;
- Passage of Government Orders (GO) requiring the use of a structured project appraisal process that considers all risk dimensions of a project (*e.g.*, stakeholders, cash-flow, logistical, financial) promoted and ensured that departmental budget officers were aware this appraisal approach and their obligation to undertake the same;
- Appointment of dedicated project appraisal team members created cohesion and continuity in team membership thereby enabling the consistent and disciplined level of effort needed to properly appraise proposed projects;
- The early identification, training, and utilization of government program and project appraisal officers to serve as trainers and change agents greatly facilitated the extension and sustained implementation of modern project appraisal techniques; and
- Periodic press coverage of the project appraisal management efforts of the state government helped to engender public and political interest in these reform efforts that, in turn, reinforces and compels the state government to continue down the reform path.

Impeding Factors

- The late involvement of the Principal Planning Secretary and that incumbent's subordinate role to the Principal Finance Secretary resulted in a loss of synergy and an inability to properly coordinate the actual use of the project appraisal techniques once the formal training had been completed;
- Due to a variety of factors, it was not possible to establish a Project Formulation and Analysis Division (PFAD) in any of the states;
- In some of the partner states, the wrong officers were selected for the first training cohort resulting in their limited interest and participation and ultimate departures before completing the series of training courses;
- A lack of sufficient manpower in some of our states resulted in the same officers multitasking on the various REFORM project interventions and capacity-building programs (e.g., Debt, Project Appraisal and PPB); and
- The long duration of the first training cohort (24 months) resulted in a high attrition rate and as a result only 25 percent of the trainees who started the course completed it.

Chapter 5: Recommendations: Immediate Next Steps

In order to maintain the momentum and sustain the project appraisal initiatives generated by the REFORM Project, the Uttarakhand project team recommends the following immediate next steps by the governments of Jharkhand, Karnataka, and Uttarakhand:

- The GoU needs to continue to ensure use of the Project Appraisal Guidelines mandated by the GoU Government Order of June 2007 to ensure viability of projects initiated by the state government;
- All three state governments need to establish a Project Formulation and Appraisal Division (PFAD) in the Department of Planning as recommended by the REFORM project;
- The Governments of Jharkhand and Karnataka need to issue government orders requiring a structured Project Appraisal process for all projects valued at more than INR 50 million;
- The Government of Jharkhand needs to continue its project appraisal training programs at the SKIPA and to initiate a parallel stream of courses at the SIRD;
- The Government of Karnataka need to ensure that project appraisal programs are organized and conducted on a regular basis at its newly-established Fiscal Policy Institute once that institute becomes fully operational in mid-2009;
- Use of the PFAD as the nodal offices for executing the June 2007 GoU GO once the project ends in September 2008; and
- Once its establishes its PFAD the GoU needs to ensure a close working relationship between this nodal project appraisal institution and the Uttarakhand Administrative Academy in Nainital and the Institute for Chartered Financial Analysts of India campus in Dehradun to offer regular training programs on Project Formulation, Implementation and Evaluation.

In closing, for more information on the project appraisal management tools and techniques implemented by the REFORM project please see the *Project Appraisal Manual and Guidelines*, which is located in *Section IV* of the *REFORM Project Compendium and Toolkit*.